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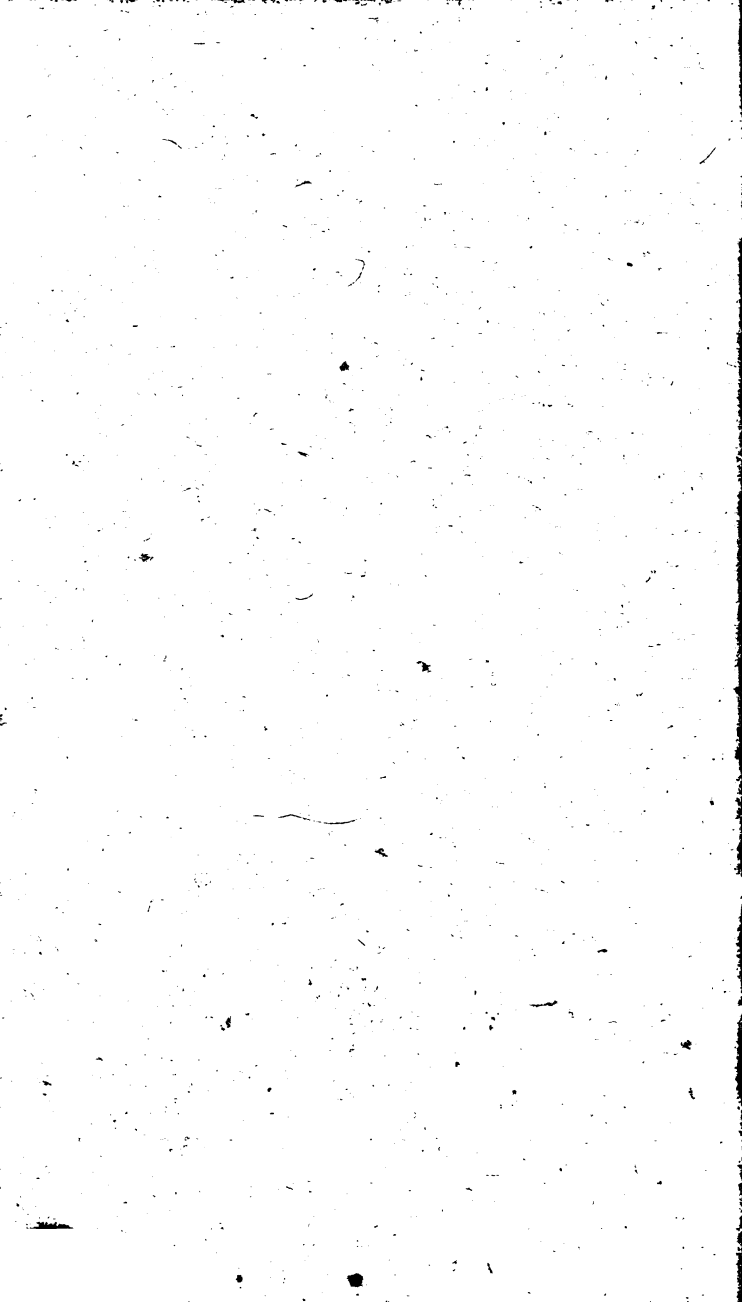
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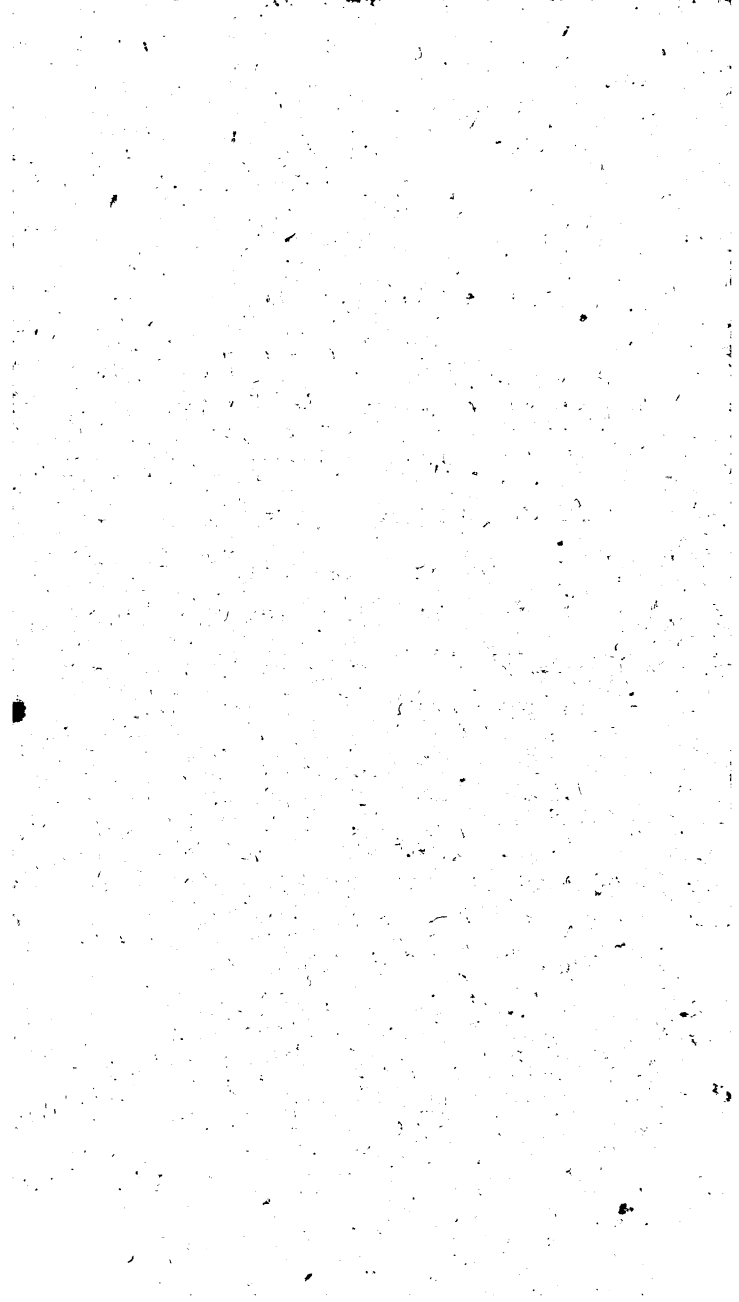
QA

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DECI







SMITH & FORMAN'S FIRST EDITION.

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A .  
**K E Y**  
TO  
**DILWORTH'S ARITHMETIC**

WHEREIN  
EVERY QUESTION IS WORKED OUT  
AT FULL LENGTH,  
*IN A SHORT AND COMPREHENSIVE MANNER*

CONTAINING, BESIDE,  
SOLUTIONS TO MANY ORIGINAL QUESTIONS

INTRODUCED  
*IN THE BEST EDITION OF THAT WORK,*  
ADAPTED TO THE  
AMERICAN ARITHMETICIAN.

---

*BY A TEACHER OF ARITHMETIC,*  
IN NEW-YORK.

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**NEW-YORK:**  
Printed and published by SMITH & FORMAN,  
AT THE FRANKLIN JUVENILE BOOKSTORES,  
195 AND 213, GREENWICH-STREET.

~~~~~  
1812.



~~~~~  
*District of New-York, ss.*

**BE IT REMEMBERED**, That on the twenty-second day of September, in the thirty-seventh year of the Independence of the United States of America, *SMITH & FORMALAN*, of the said district, have deposited in this office, the title of a Book, the right whereof they claim as proprietors in the words following, to wit: 'A KEY TO *DILWORTH'S ARITHMETIC*; wherein every question is worked out at full length, in a short and comprehensive manner. Containing, beside, solutions to many original questions introduced in the best edition of that work, adapted to the American arithmetician. By a Teacher of Arithmetic, in New-York.'

In conformity to the act of the Congress of the United States, entitled, 'An act for the encouragement of learning, by securing the copies of Maps, Charts, and Books, to the authors and proprietors of such copies, during the time therein mentioned. And also, to an act, entitled, 'An act, supplementary to an act, entitled, 'An act for the encouragement of learning, by securing the copies of Maps, Charts, and Books, to the authors and proprietors of such copies, during the times therein mentioned, and extending the benefits thereof to the arts of designing, engraving, and etching historical and other prints.

**CHARLES CLINTON,**

*Clerk of the District of New-York.*



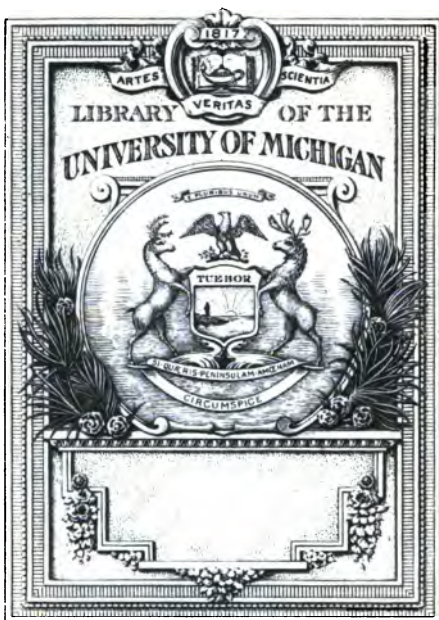


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3-24-45  
52211

## PREFACE.

IN presenting this work to the public, the author is conscious of its many imperfections; but his confidence that its utility will more than counterbalance those errors, ever incident to a first effort, prompts him, with no inconsiderable anxiety, to submit it to the unerring tribunal of public opinion.

That works of this kind, when rightly conducted, are of incalculable advantage to society, will readily be admitted; especially in such a thinly settled country as many parts of the United States.—With little or no society, but his own domestic circle, the enterprising farmer, undaunted by dangers and difficulties, sets down in a boundless forest to provide for the dear partner and pledges of his affections. Isolated from the world, with but scanty resources, and, too frequently, a very imperfect education, though he can provide for all the wants of nature, yet has he the dreary prospect before him of rearing his beloved offspring with minds but little more cultivated than the poor, wandering savage whom he has driven from his rightful soil. In cities too, and, in truth, in every clime, how many enterprising minds are struggling against circumstances—how many by “chill penury” have the “genial current of the soul repressed” from those surprising flights of which the human mind is capable. Could, then, a course of studies be devised that would preclude the necessity of such long and frequent recourse to tutors and public institutions—whereby the pupil could be his own instructor, would not the advantage to the community be unlimited? This, in as far as it constitutes a part of education, is the design of the present work. From it the learner will be enabled to perceive how all ordinary calculations in arithmetic are made, with but little or no assistance. He will also have sufficient exercises in pursuing the reason—

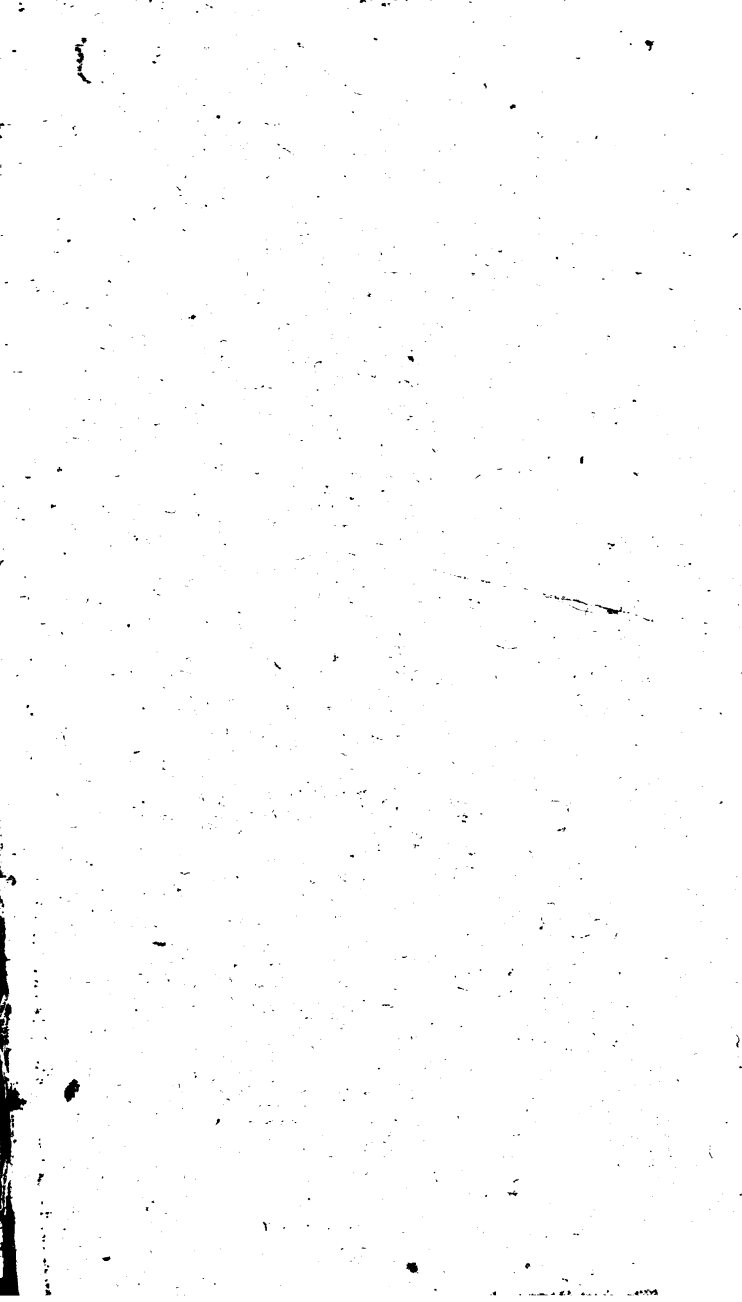


QA

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D5811





## [SUBTRACTION.]

[7]		[8]	
<i>l.</i>	<i>s.</i>	<i>l.</i>	<i>s.</i>
100	10	60	00
190	4	80	00
109	6	1	10
<hr/>		<hr/>	
400	00	141	10
<hr/>		<hr/>	

## SIMPLE SUBTRACTION.

641.—5727.—27396.—639402.—4800345.—11382384.—  
139495415.—44590857.—1701724.

COMPOUND SUBTRACTION.  
MONEY.

	<i>l.</i>	<i>s.</i>	<i>d.</i>		<i>l.</i>	<i>s.</i>	<i>d.</i>
1	10	12	10	7	54	3	5½
2	19	00	4½	8	3	4	11½
3	48	19	3½	9	60	18	10½
4	14	19	3½	10	18	4	11½
5	30	18	1½	11	241	12	10½
6	62	5	9½	12	53	1	11½
Borrowed	764	0	0	Lent	800	10	6
Paid in all	139	5	11½	Received in all	162	18	10½
<hr/>				<hr/>			
Unpaid	624	14	0½	Remains due	637	11	7½
<hr/>				<hr/>			
<i>£.</i>	<i>c.</i>	<i>m.</i>	<i>£.</i>	<i>c.</i>	<i>m.</i>	<i>£.</i>	<i>c.</i>
30	56	7.—	59	75	6.—	244	88.

## TROY WEIGHT.

[1] 69oz. Odwt. 17gr.—[2] 61oz. 7dwt. 23gr.—  
[3] 7oz. 16dwt. 22gr.—[4] 66lb. 5oz. 19dwt. 19gr.

## AVOIRDUPOIS WEIGHT.

[1] 68cwt. 3gr. 20lb.—[2] 6lb. 4oz. 15dr.—[3] 1lb. 11oz. 4dr.  
[4] 6T. 18cwt. 0gr. 19lb.

## APOTHECARIES' WEIGHT.

[1] 57½ 43 29 18gr.—[2] 45½ 33 19 18gr.—  
[3] 38lb 0½ 73 19 2gr.

## LONG MEASURE.

[1] 56Le. 1m. 5fu. 34p.—[2] 34yds. 0ft. 2in. 1b.c.—  
[3] 41Le. 1m. 6fu. 23p.

# SUBTRACTION.

5

## CLOTH MEASURE.

- [1] 57yd. 0qr. 2n.—[2] 35*E.F.* 1qr. 0n.—[3] 35yd. 0qr. 2n.  
[4] 2*E. E.* 2qr. 3n.

Yds. qr. n.

A draper bought 148 0 0

Sold in all 86 0 3

Unsold 61 3 1

## LAND MEASURE.

- [1] 6a. 1r. 33p.—[2] 4a. 3r. 34p.—[3] 8a. 3r. 19p.—  
[4] 15a. 1r. 26p.

## WINE MEASURE.

- [1] 1*T.* 2hhd. 54gal.—[2] 5*T.* 3hhd. 45gal.—  
[3] 7gal. 1qt. 0pt —[4] 54gal. 2qt. 1pt.

## WINCHESTER MEASURE.

- [1] 4hhd. 52gal. 3qt.—[2] 3*A.B.* 0f. 2gal.—  
[3] 30*B.B.* 3f 5gal.—[4] 17hhd. 52gal. 3qt.

## DRY MEASURE.

- [1] 7ch. 0bu. 2p.—[2] 23ch. 32bu. 1p.—[3] 6qr. 1bu. 3p.—  
[4] 6qr. 7bu. 1p.

## TIME.

- [1] 18d. 20h. 48m. 41sec.—[2] 3w. 4d. 14h. 23m. 44sec.—  
[3] 6w. 5d. 20h. 5m. 55sec.

## MOTION.

- [1] 28° 58' 59".—[2] 34° 42' 2".—[3] 12° 53' 36".

## QUESTIONS TO EXERCISE SUBTRACTION.

[1]	[2]	[3]
1781	61	61
1702	44	17

Answer 79 years. 17 dif. 44 less number.

[4]	[5]	[6]
<i>l. s. d.</i>	<i>l. s.</i>	
45 19 0	30 00	1811
26 00 7½	12 10	1648
19 18 4½ due to the baker.	17 10 unpaid.	163 years.

## MULTIPLICATION.

<i>Gallons.</i>	<i>Case 4. Eggs.</i>	<i>Buttons.</i>
128121	128128	246145
72001	70043	60012
<hr/>	<hr/>	<hr/>
128121	384384	2953740
256242	512512	1476870
896847	896896	<hr/>
<hr/>	<hr/>	<hr/>
9224840121	8974469504	14771653740
<hr/>	<hr/>	<hr/>

<i>Pounds.</i>	<i>Case 5. Men.</i>	<i>Soldiers.</i>	<i>Sailors.</i>
764126	764131	461231	461312
5	6	8	6
<hr/>	<hr/>	<hr/>	<hr/>
3820630	4584786	3689848	2767872
7	8	9	6
<hr/>	<hr/>	<hr/>	<hr/>
26744410	36678288	33208632	16607232
<hr/>	<hr/>	<hr/>	<hr/>

## COMPOUND MULTIPLICATION.

<i>l. s. d.</i>	<i>lb oz. dwt. grs.</i>	<i>C gr. lb.</i>	<i>lb. oz. dr.</i>
17 3 1 $\frac{1}{4}$	17 5 12 16	43 1 14	17 12 10
2	3	4	5
<hr/>	<hr/>	<hr/>	<hr/>
34 6 2 $\frac{1}{2}$	52 4 18 00	173 2 00	88 15 2
<hr/>	<hr/>	<hr/>	<hr/>
<i>M. fu. ft.</i>	<i>Yd. ft. in. bc.</i>	<i>Yd. qr na.</i>	<i>B.B fir gal.</i>
16 4 21	17 2 3 1	16 3 2	17 2 3
6	7	8	9
<hr/>	<hr/>	<hr/>	<hr/>
99 3 06	121 0 11 1	135 0 0	158 1 0
<hr/>	<hr/>	<hr/>	<hr/>
<i>Ch. bu. ft.</i>	<i>M. w. d.</i>	<i>D. h m. sec.</i>	<i>o ' "</i>
16 12 3	16 3 4	17 14 14 15	16 11 13
10	11	12	7
<hr/>	<hr/>	<hr/>	<hr/>
163 19 2	185 3 2	211 2 51 00	113 18 31
<hr/>	<hr/>	<hr/>	<hr/>
<i>£. c m.</i>	<i>£. c m.</i>	<i>£. c.</i>	<i>£. c.</i>
79 47 3	83 47 6	74 25	48 36
6	7	8	5
<hr/>	<hr/>	<hr/>	<hr/>
476 83 8	584 33 2	594 00	241 80
<hr/>	<hr/>	<hr/>	<hr/>



# DIVISION.

9

## QUESTIONS TO EXERCISE MULTIPLICATION.

[1]	[2]	[3]	[4]
s.	76	124	27
3	3	3	10000
40			
<u>        </u>	<u>        </u>	<u>        </u>	<u>        </u>
An. 120	228	£ 372 An.	£ 270000 An.
<u>        </u>	7	<u>        </u>	<u>        </u>

An. 1596

[5]	[6]	[7]
1271	126	769
40	12	9
<u>        </u>	<u>        </u>	<u>        </u>
50840 An.	1512 An.	6921
<u>        </u>	<u>        </u>	7
		<u>        </u>
		48447 An.
		<u>        </u>

## SIMPLE DIVISION.

### SHORT DIVISION.

2)71313674	3)42310812	4)13812612
<u>        </u>	<u>        </u>	<u>        </u>
35656837	14103604	3453153
<u>        </u>	<u>        </u>	<u>        </u>
5)61231281	6)31210841	7)713126719
<u>        </u>	<u>        </u>	<u>        </u>
12246256½	5201806⅔	101875245⅔
<u>        </u>	<u>        </u>	<u>        </u>
8)701267131	9)126713108	11)7312613107
<u>        </u>	<u>        </u>	<u>        </u>
87658391⅔	14079234⅔	664783009⅔
<u>        </u>	<u>        </u>	<u>        </u>
12)3812617314	11)1612798131	12)1731261712
<u>        </u>	<u>        </u>	<u>        </u>
317718109⅔	146618011⅔	144271809⅔
<u>        </u>	<u>        </u>	<u>        </u>

# DIVISION. LONG DIVISION.

Case 1.

$$91)72265871(794130\frac{41}{51}$$

637

856

819

375

364

118

91

277

273

$\frac{41}{51}$

$$82)31712617(386739\frac{12}{11}$$

246

711

656

552

492

606

574

321

246

757

738

$\frac{12}{11}$

$$73)17312618(237159\frac{12}{73}$$

146

271

219

522

511

116

73

431

365

668

657

$\frac{12}{73}$

$$64)47312617(739259\frac{41}{64}$$

448

251

192

592

576

166

128

381

320

617

576

$\frac{41}{64}$

# DIVISION: 1

11

55)73181061(1330564 $\frac{1}{3}$

55

181

165

168

165

310

275

356

330

261

220

$\frac{41}{55}$

46)76131714(1655037 $\frac{1}{4}$

46

301

276

253

230

231

230

171

138

334

322

$\frac{13}{46}$

37)31231712(844100 $\frac{1}{3}$

296

163

148

151

148

37

37

$\frac{13}{37}$

28)71261714(2545061 $\frac{1}{2}$

56

152

140

126

112

141

140

171

168

34

28

$\frac{5}{28}$

19)73126171(38487451 $\frac{1}{2}$ 

57

161

152

92

76

166

152

141

133

87

76

111

95

18

18

761)12816171(1684117 $\frac{1}{2}$ 

761

5206

4566

6401

6088

3137

3044

931

761

170

161

381)13261714(3460711 $\frac{1}{2}$ 

1143

1831

1524

3077

3048

2914

2667

247

311

937)13189714(1407619 $\frac{1}{2}$ 

937

3819

3748

7171

6559

6124

5622

502

517

7618)18917312(2483181 $\frac{1}{2}$ 

15236

36813

30472

63411

60944

24672

22854

1818

1818

1217)31917312(26226<sup>370</sup><sub>1217</sub>

2434

7577

7302

2753

2434

3191

2434

7572

7302

370<sub>1217</sub>2912)17161231(5893<sup>316</sup><sub>2912</sub>

14560

26012

23296

27163

26208

9551

8736

815<sub>2912</sub>33108)91261814(27561<sup>166</sup><sub>33108</sub>

66216

250458

231756

187021

165540

214814

198648

16166<sub>33108</sub>3164)12697126(40123<sup>163</sup><sub>3164</sub>

12656

4112

3164

9486

6328

3158<sub>3164</sub>6128)71217312(11621<sup>3824</sup><sub>6128</sub>

6128

9937

6128

38093

36768

13251

12256

9952

6128

3824<sub>6128</sub>71216)17131716(2403<sup>9876</sup><sub>71216</sub>

142432

288851

284864

39876<sub>71216</sub>86257)34175362(3961<sup>7580</sup><sub>86257</sub>

258771

829826

776313

535132

517542

17590<sub>86257</sub>

## Case 2.

$$625,00)712613,12(1140\overset{1111}{\underset{1111}{1111}} \quad 426,00)713121,74(1673\overset{42374}{\underset{42374}{42374}}$$

625

426

876

2871

625

2556

2511

3152

2500

2982

$$\begin{array}{r} 1111 \\ 625000 \end{array}$$

1701

1278

$$128,000)71116,071(555\overset{76071}{\underset{128000}{76071}}$$

640

$$\begin{array}{r} 42374 \\ 42374 \end{array}$$

$$412,000)71613,181(173\overset{337181}{\underset{412000}{337181}}$$

711

412

640

3041

716

2884

640

1573

1236

$$\begin{array}{r} 76071 \\ 128000 \end{array}$$

$$\begin{array}{r} 337181 \\ 412000 \end{array}$$

## Case 3.

*Pence.**Crowns.**Pounds.*

$$5)26744410$$

$$6)36678288$$

$$8)33208632$$

$$7)5348882$$

$$8)6113048$$

$$9)4151079$$

764126

764131

461231

## COMPOUND DIVISION.

$$\begin{array}{r} \text{lb. s. d.} \\ 2)48 \ 12 \ 6\frac{1}{2} \end{array}$$

$$\begin{array}{r} \text{lb. oz. dwt. gr.} \\ 3)14 \ 10 \ 3 \ 14 \end{array}$$

$$\begin{array}{r} \text{T. C. gr. lb.} \\ 4)17 \ 1 \ 1 \ 15 \end{array}$$

24 6 3 $\frac{1}{2}$ 4 11 7 20 $\frac{1}{2}$ 4 5 1 10 $\frac{1}{2}$ 

$$\begin{array}{r} \text{lb. oz. dr.} \\ 5)16 \ 12 \ 11 \end{array}$$

$$\begin{array}{r} \text{M. f. p.} \\ 6)38 \ 2 \ 14 \end{array}$$

$$\begin{array}{r} \text{Y. ft. in. b. c.} \\ 7)46 \ 0 \ 10 \ 2 \end{array}$$

3 5 11 $\frac{1}{2}$ 6 3 2 $\frac{3}{4}$ 6 1 10 0 $\frac{1}{2}$

# DIVISION.

15

*Yd. qr. na.*

$$\begin{array}{r} 8 \overline{)16 \ 2 \ 2} \\ \underline{\phantom{00}00} \phantom{00} \\ 2 \ 0 \ 1 \frac{1}{2} \end{array}$$

*A.B. fir. gal.*

$$\begin{array}{r} 9 \overline{)17 \ 3 \ 2} \\ \underline{\phantom{00}00} \phantom{00} \\ 1 \ 3 \ 7 \frac{2}{9} \end{array}$$

*Ch. bu. p.*

$$\begin{array}{r} 10 \overline{)20 \ 13 \ 2} \\ \underline{\phantom{00}00} \phantom{00} \\ 2 \ 1 \ 1 \frac{4}{10} \end{array}$$

*M. w. d.*

$$\begin{array}{r} 11 \overline{)48 \ 2 \ 2} \\ \underline{\phantom{00}00} \phantom{00} \\ 4 \ 1 \ 4 \frac{7}{11} \end{array}$$

*D. h. m. sec.*

$$\begin{array}{r} 12 \overline{)46 \ 16 \ 12 \ 30} \\ \underline{\phantom{00}00} \phantom{00} \\ 3 \ 21 \ 21 \ 2 \frac{6}{12} \end{array}$$

*o ' "*

$$\begin{array}{r} 12 \overline{)33 \ 4 \ 11} \\ \underline{\phantom{00}00} \phantom{00} \\ 2 \ 45 \ 20 \frac{11}{12} \end{array}$$

*c. m.*

$$\begin{array}{r} 8 \overline{)94 \ 87 \ 3} \\ \underline{\phantom{00}00} \phantom{00} \\ 13 \ 55 \ 3 \frac{3}{8} \end{array}$$

*c. m.*

$$\begin{array}{r} 8 \overline{)69 \ 47 \ 3} \\ \underline{\phantom{00}00} \phantom{00} \\ 13 \ 89 \ 4 \frac{3}{8} \end{array}$$

*c. m.*

$$\begin{array}{r} 8 \overline{)627 \ 43 \ 5} \\ \underline{\phantom{00}00} \phantom{00} \\ 78 \ 42 \ 9 \frac{3}{8} \end{array}$$

## QUESTIONS TO EXERCISE DIVISION.

[1]

$$\begin{array}{r} 4 \overline{)140s.} \\ \underline{\phantom{00}00} \phantom{00} \\ 10 \overline{)35} \end{array}$$

[2]

$$\begin{array}{r} 3 \overline{)1596} \\ \underline{\phantom{00}00} \phantom{00} \\ 7 \overline{)532} \end{array}$$

[3]

$$\begin{array}{r} 124 \overline{)372(3 \text{ Ans.}} \\ \underline{\phantom{00}00} \phantom{00} \\ 372 \end{array}$$

Ans. 3s. 6d.

Ans. 76

[4]

$$\begin{array}{r} 19,000 \overline{)2660,000(140} \\ \underline{\phantom{00}00} \phantom{00} \\ 19 \end{array}$$

[5]

$$\begin{array}{r} 3 \overline{)1272} \\ \underline{\phantom{00}00} \phantom{00} \\ 424 \text{ Men.} \end{array}$$

[6]

$$\begin{array}{r} 9 \overline{)48447} \\ \underline{\phantom{00}00} \phantom{00} \\ 7 \overline{)5383} \end{array}$$

76

76

0

[7]

$$\begin{array}{r} 12 \overline{)3264} \\ \underline{\phantom{00}00} \phantom{00} \\ 4 \overline{)272} \end{array}$$

Ans. 68

[8]

*Miles.*

$$\begin{array}{r} 136 \overline{)3264(24 \text{ Ans.}} \\ \underline{\phantom{00}00} \phantom{00} \\ 272 \end{array}$$

544

544

769 Ans.

## REDUCTION DESCENDING.

$$\begin{array}{r}
 [1] \\
 \text{£.} \\
 46 \\
 20 \\
 \hline
 920 \text{ s.} \\
 12 \\
 \hline
 11040 \text{ d.} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 [2] \\
 \text{£.} \\
 7 \\
 20 \\
 \hline
 140 \text{ s.} \\
 12 \\
 \hline
 1680 \text{ d.} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 [3] \\
 \text{£.} \\
 9 \\
 20 \\
 \hline
 180 \text{ s.} \\
 12 \\
 \hline
 2160 \text{ d.} \\
 4 \\
 \hline
 8640 \text{ grs.} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 [4] \\
 \text{l. s. d.} \\
 7 \quad 14 \quad 6\frac{1}{2} \\
 20 \\
 \hline
 154 \text{ s.} \\
 12 \\
 \hline
 1854 \text{ d.} \\
 4 \\
 \hline
 7417 \text{ grs.} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 [5] \\
 \text{l. s. d.} \\
 46 \quad 14 \quad 9\frac{3}{4} \\
 20 \\
 \hline
 934 \text{ s.} \\
 12 \\
 \hline
 11217 \text{ d.} \\
 4 \\
 \hline
 44871 \text{ grs.} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 [6] \\
 \text{l. s. d.} \\
 50 \quad 9 \quad 9\frac{1}{2} \\
 20 \\
 \hline
 1009 \text{ s.} \\
 12 \\
 \hline
 12117 \text{ d.} \\
 2 \\
 \hline
 24235 \text{ h. p.} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 [7] \\
 \text{l. s. d.} \\
 160 \quad 15 \quad 6 \\
 20 \\
 \hline
 3215 \text{ s.} \\
 2 \\
 \hline
 6431 \text{ s. p.} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 [8] \\
 \text{l. s. d.} \\
 48 \quad 12 \quad 8 \\
 20 \\
 \hline
 972 \text{ s.} \\
 3 \\
 \hline
 2918 \text{ gr.} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 [9] \\
 \text{l. s. d.} \\
 90 \quad 17 \quad 6 \\
 20 \\
 \hline
 1817 \text{ s.} \\
 6 \\
 \hline
 10905 \text{ two p.} \\
 \hline
 \end{array}$$



## REDUCTION.

17

[10]	[11]	[12]	[13]	[14]	[15]
Cr.	£.	H. C.	Cr.	S. P.	Cr.
12	15	50	306	120	210
5	4	30	2	2	5
—	—	—	—	—	—
60 s.	60 cr.	1500 d.	612 h. c.	240 th. p.	1050 s.
12	5	4	30	3	3
—	—	—	—	—	—
720 d.	360 s.	6000 grs.	18360 d.	720 d.	3150 gr
—	—	—	—	4	4

2880 *grs.* 12600 *d.*

[16]	[17]	[18]	[19]	[20]
£.	Gui.	£.	£.	£. c. m.
86	17	28	127	47 83 4
4	21	4	100	100
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
344 cr.	17	112 Cr.	12700 cts.	4783 c.
5	34	10	<hr/>	10
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
1720 s.	357 s.	1120 s. p		47834 m.
3	12	<hr/>		<hr/>
<hr/>	<hr/>			
5160 gr.	4284 d.			

### REDUCTION ASCENDING.

[1] d.	[2] d	[3] grs.	[4] grs.
12)11040	12)1680	4)8640	4)7417
2,0)92,0 s.	2,0)14,0 s.	12)2160 d.	12)1854 $\frac{1}{2}$
46 £.	7 £.	2,0)18,0 s.	2,0)15,4 6 $\frac{1}{2}$
[5] grs.	[6] H P.	9 £.	£. 7 14 6 $\frac{1}{2}$
4)44871	2)24235		[7] s. fl.
12)11217 $\frac{1}{2}$	12)12117 $\frac{1}{2}$		2)6431
2,0)93.4 9 $\frac{1}{2}$	2,0)100.9 9 $\frac{1}{2}$		2,0)321,5 6
£. 46 14 9 $\frac{3}{4}$	£. 50 9 9 $\frac{1}{2}$		£. 160 15 6

**B 2**

[8]

*gr.*

3)2918

2,0)97,2 8

£. 48 12 8

[9]

*two fl.*

6)10905

2,0)181,7 6

£. 90 17 6

[10]

*d.*

12)720

5)60 s.

12 cr.

[11]

*s.*

5)300

4)60 cr

15 £.

[12]

*grs.*

4)6000

3,0)150,0 d.

50 h. cr.

[13]

*d.*

3,0)1836,0

2)612 h. cr.

306 Cr.

[14]

*grs.*

4)2880

3)720 d.

2)240 th. fl.

120 s. fl.

[15]

*d.*

4)12600

3)3150 gr.

5)1050 s.

210 cr.

[16]

*gr.*

3)5160

5)1720 s.

4)344 cr.

86 £.

[17]

*d.*

12)4284

21)357 s.

17 gui.

[18]

*six fl.*

10)1120

4)112 cr.

28 £.

[19]

*cts.*

1,00)7530,00

\$ 7530

[20]

*mills.*

10)39428

1,00)39,42 8 m.

\$ 39 42c. 8m.

## REDUCTION ASCENDING AND DESCENDING.

[1]	[2]	[3]	[4]
<i>s.</i>	<i>s.</i>	<i>Cr.</i>	<i>h. cr.</i>
720	5)120	60	2)612
12	—	5	—
—	24 <i>cr.</i>	—	306 <i>cr.</i>
6,0)864,0 <i>d.</i>	2	2,0)30,0 <i>s.</i>	60
—	—	—	—
144 <i>Cr.</i>	48 <i>h. cr.</i>	15 <i>s.</i>	18360 <i>d.</i>
—	—	—	—

[5]	[6]	[7]	[8]
<i>gui.</i>	<i>d.</i>	<i>cr.</i>	<i>moi.</i>
40	12)12600	63	70
21	—	5	27
—	1050 <i>s.</i>	—	—
5)840 <i>s.</i>	3	21)315 <i>s.</i>	2,0)189,0
—	—	—	—
4)168 <i>cr.</i>	15)3150 <i>gr.</i>	15 <i>gui.</i>	£. 94 10 <i>s.</i>
—	—	—	—
42 <i>s.</i>	210 <i>cr.</i>	—	—
—	—	—	—

[9]	[10]	[11]	[12]
<i>th. p.</i>	<i>s.</i>	<i>s.</i>	<i>six. p.</i>
4)12180	5)1720	121	4,0)112,0
—	—	3	—
3045 <i>s.</i>	344 <i>cr.</i>	—	28 <i>s.</i>
12	15	363 <i>gr.</i>	4
—	—	4	—
4)36540 <i>d.</i>	6,0)516,0 <i>gr.</i>	—	112 <i>cr.</i>
—	—	3)1452 <i>d.</i>	—
9135 <i>gr.</i>	86 <i>s.</i>	—	—
—	—	2)484 <i>three pences.</i>	—
—	—	—	—
—	—	242 <i>six pences.</i>	—
—	—	—	—

[13]

£

280

20

1 cr. = 60

1 h. cr. = 30

1 s. = 12

102) 67200 (658 of each,  
612 & 7s. over.

600

510

900

816

12) 84d.

7s.

[16]

£ s.

5 10

4

22 0

4

88 0 Ans.

[17]

£ s.

17) 34 17

2 1 Ans.

[14]

£ s.

17 10

20

350

4

21) 1400 (66 guineas, and  
126 14s. over.

140

126

14s.

[15]

£ s.

1 1

12

12 12

12

[18]

Moid.

19

27

133

38

2,0) 51.3s.

25 13s.

£ 151 4s. Ans.

## TROY WEIGHT.

[1]

lb. oz.

47 10

12

574oz.

20

11480dwt.

24

45920

22960

275520gr.

[3]

oz. dwt.

5 10

20

110

lb.

10

12

120

20

11,0)240,0

[2]

24)47128(2,0(196,3

24

231

216

152

144

88

72

16gr.

12)98 3dwt.

8lb. 2oz. 3dwt. 16gr.

[4]

 $\frac{1}{3}$  oz. = 10dwt.

24

240)4560(19 tea spoons.

240

2160

2160

21 spoons, and 90dwt. over.

[5]

oz.

20

47

12)940oz.

78lb. 4oz.

11oz.

20

220

[6]

lb. oz. dwt.

19 10 11

12

238

20

220)4771(21 porringers, and

440

151dwt. over.

[7]

oz.

2

5

1

2

10

oz.

27

3

10)81

Spoons of

Cups

Salts

Snuff boxes

371

220

151

8 of each sort, and 1oz. over.

## REDUCTION.

[8]  
 oz. dwf.  
 27 10  
 20  
 —  
 550 dwf.  
 24  
 —  
 2200  
 1100  
 —  
 13200 gr.  
 17  
 —  
 224400 gr.  
 —

## AVOIRDUPOIS WEIGHT.

Case 1.

[F]	[2]	[3]
C. gr. lb.	T.	lb.
7 3 10	8	16)14048 4
4	20	— —
—	—	28)878(31
31 gr.	60 C.	84 —
28	4	— 7 C. 3 gr. 10 lb.
—	—	38
258	240 gr.	28
62	28	—
—	—	[4] 10
878 lb.	1920	lb.
16	480	28)6720(4)240 gr.
—	—	56 —
14048 oz.	6720 lb.	— 2,0)6,0 C.
16	—	112 —
—	—	112 3 T.
224768 dr.	—	—
—	—	0
—	—	—

<p>[5] St. lb. 461 24 — 1844 922 —</p>	<p>[6] dr. 16)40426 — 24)2526oz.10dr. — 105gr.lb. 6oz. 10dr.</p>	<p>[7] 3lb. 16 — 12)48 — 4 parcels.</p>
<p>11064oz. 16 — 177024dr.</p>	<p>[8] lb. 26 470 — 1820 104 —</p>	<p>[9] 672gr. lb. 3 — 2)2016 — 1008lb.</p>
<p>[11] C. gr. 7 2 8 — 60 0 112 — 6720lb.</p>	<p>28)12220(4)436 112 — 109 C. 0gr. 12lb. 102 84 — 180 168 — 12lb.</p>	<p>[10] 480lb. 2 — 3)960 — 320gr. lb.</p>
<p>C. gr. [12] 19 2 C. gr. 4 4 — 78 19 17 — 78)323(4F. 2C. 3gr. 312 — 4)11 — 2C. 3gr.</p>	<p>[13] C. 712 4 — 78 78)2848(36F. 10C. 234 — 508 468 — 4)40 — 10C.</p>	<p>[14] C. gr. lb. 17 1 6 4 — 69 28 — 558 138 — 17)1938(114 par- 17 cels. — 23 17 — 68 68 —</p>

## REDUCTION.

Case 2.

## TARE AND TRETT.

$$\begin{array}{r}
 \text{[1]} \\
 \text{C. gr. lb.} \\
 \text{lb. } 5 \quad 1 \quad 19 \\
 100 = 0 \quad 3 \quad 16 \\
 \hline
 4 \quad 2 \quad 3 \\
 \phantom{4 \quad 2} 16 \\
 \hline
 \text{neat } 72 \quad 1 \quad 20
 \end{array}$$

$$\begin{array}{r}
 \text{[2]} \\
 317 \text{ lb.} \\
 16 \text{ lb.} \\
 \hline
 301 \\
 70 \\
 \hline
 \text{neat } 21070 \text{ lb.}
 \end{array}$$

$$\begin{array}{r}
 \text{[3]} \\
 14 \text{ lb.} \\
 100 \\
 \hline
 112)1400(12 \text{ C.} \\
 112 \\
 \hline
 280 \\
 224 \\
 \hline
 28)56(2 \text{ gr.} \\
 56
 \end{array}$$

$$\begin{array}{r}
 \text{[4]} \\
 249 \\
 14 \\
 \hline
 235 \\
 30 \\
 \hline
 7050 \text{ lb. neat}
 \end{array}$$

$$\begin{array}{r}
 \text{C. gr. lb.} \\
 89 \quad 3 \quad 17 \text{ gross.} \\
 12 \quad 2 \quad 00 \text{ tare} \\
 \hline
 77 \quad 1 \quad 17 \text{ neat}
 \end{array}$$

Case 3.

$$\begin{array}{r}
 \text{[1]} \\
 \text{C. gr. lb.} \\
 14 = \frac{1}{8})48 \quad 3 \quad 12 \text{ gross} \\
 \phantom{14 = \frac{1}{8})} 6 \quad 0 \quad 12 \text{ tare} \\
 \hline
 42 \quad 3 \quad 00 \text{ neat}
 \end{array}$$

$$\begin{array}{r}
 \text{[2]} \\
 \text{C. gr. lb.} \\
 7 \quad 1 \quad 10 \\
 12 \\
 \hline
 16 = \frac{1}{7})88 \quad 0 \quad 8 \quad 0 \text{ gross} \\
 \phantom{16 = \frac{1}{7})} 12 \quad 2 \quad 9 \quad 2 \text{ tare} \\
 \hline
 75 \quad 1 \quad 26 \quad 14 \text{ neat}
 \end{array}$$

$$\begin{array}{r}
 \text{[3]} \\
 \text{C. gr.} \\
 2 \quad 3 \\
 5 \\
 \hline
 13 \quad 3 \\
 6 \\
 \hline
 14 = \frac{1}{8})82 \quad 2 \quad 00 \text{ gross} \\
 \phantom{14 = \frac{1}{8})} 10 \quad 1 \quad 7 \text{ tare} \\
 \hline
 72 \quad 0 \quad 21 \text{ neat}
 \end{array}$$



# REDUCTION.

25

[4] lb. oz.  
 33 660 0 gross  
 20 58 14 tare  


---

 660 601 2 neat  
 10

[5] lb. oz.  
 223 3791 00 gross  
 17 338 7 tare  


---

 3791 3452 9 neat  
 10

112)6600(58  
 560  


---

 1000  
 896  


---

 104  
 16

112)37910(338  
 336  


---

 431  
 336  


---

 950  
 896

112)1664(14  
 112  


---

 544  
 448  


---

 96

54  
 16  


---

 112)864(7  
 784  


---

 80

Case 4.

[1]  
 28)3140(4)112  
 28  


---

 34  
 28  


---

 60  
 56  


---

 4 lb.

C. gr. lb.  
 201 3 12 gross  
 28 0 4 tare  


---

 173 3 8 neat

C

## REDUCTION.

[2]

C. gr. lb.					C. gr. lb.
3	1	2	gross	80 lb. =	0 2 24 tare
3	2	1		80	0 2 24
5	1	12		100	0 3 16
<hr/>					
12	0	15	gross		2 1 8
2	1	8	tare		
<hr/>					
9	3	7	neat		
<hr/>					

Case 5.

[1]

C. gr. lb.		
8	3	20
4		
<hr/>		
35		
28		
<hr/>		
300		
70		
<hr/>		
1000	gross	
38	tare	
<hr/>		
26)962	suttle	
	37 trett	
<hr/>		
Ans.	925 lb. neat	
<hr/>		

[2]

C. gr. lb.			
8 = $\frac{1}{14}$	177	0	22 gross
<hr/>			
1 = $\frac{1}{8}$	12	2	17
	1	2	9
<hr/>			
	14	0	26 tare
<hr/>			
26)	162	3	24 suttle
	6	1	2 trett
<hr/>			
	156	2	22 neat
<hr/>			

[3]

C. gr. lb.			
	120	2	0 gross
176 lb. =	1	2	8 tare
<hr/>			
26)	118	3	20 suttle
	4	2	8 trett
<hr/>			
	114	1	12 neat
<hr/>			

## APOTHECARIES' WEIGHT.

[1]	[2]
lb. $\frac{3}{4}$ 3. 3. 9. gr.	
12 1 2 0 1	2,0)6972,1 gr.
12	
<hr/>	<hr/>
145 $\frac{3}{4}$	3)3486 lgr.
8	
<hr/>	<hr/>
1162 $\frac{3}{4}$	8)1162 09 lgr.
3	
<hr/>	<hr/>
3486 9	12)145 23 09 lgr.
20	
<hr/>	<hr/>
69721 gr.	12lb 13 23 09 lgr.
<hr/>	<hr/>

## LONG MEASURE.

[1]	[2]	[3]
70 m.	40 yds.	5 mi.
8	3	8
<hr/>	<hr/>	<hr/>
560 fu.	120 ft.	40 fur.
40	12	40
<hr/>	<hr/>	<hr/>
22400 fo.	1440 in.	1600 fo.
	3	5 $\frac{1}{2}$
<hr/>	<hr/>	<hr/>
	4320 b.c.	8000
		800
		<hr/>
		8800 yds.
		3
		<hr/>
		26400 ft.
		12
		<hr/>
		316800 in.
		3
		<hr/>
		950400 b.c.
		<hr/>

[4]  
12)4000 in.  

---

3)333 4 in.  

---

111 yds. 4 in.  

---

[5]	[6]	[7]
4 <i>lc.</i>	<i>m.</i> <i>yds.</i> $\frac{3}{1}$	1 <i>m.</i>
3	1 = 1760) 15840 (9 <i>miles.</i>	8
—	15840 —	—
12 <i>m.</i>	— 3 <i>leagues.</i>	8 <i>fu.</i>
8	—	40
—	—	—
96 <i>fu.</i>	—	320 <i>po.</i>
40	—	5½
—	—	—
3840 <i>po.</i>	—	1600
5½	—	160
—	—	—
19200	—	1760 <i>yds.</i>
1920	—	3
—	—	—
21120 <i>yds.</i>	—	5280 <i>ft.</i>
—	—	12
—	—	—
<i>ft. in.</i> [8] <i>m.</i>	[9]	63360 <i>in.</i>
18 6 150	360 <i>deg.</i>	3
12 8	69½	—
—	—	190080 <i>b.c.</i>
222 1200	—	—
40	—	—
—	3240	—
48000	2160	—
5½	180	—
—	25020 <i>m.</i>	—
240000	8	—
24000	200160 <i>fur.</i>	—
264000	40	—
3	8006400 <i>po.</i>	—
792000	5½	—
12	—	—
222) 9504000 (42810 <i>times</i>	40032000	—
888 & 180 <i>in. over.</i>	4003200	—
624	44035200 <i>yds.</i>	—
444	3	—
1800	132105600 <i>ft.</i>	—
1776	12	—
240	1585267200 <i>in.</i>	—
222	3	—
180	4755801600 <i>b.c.</i>	—
—	—	—

## CLOTH MEASURE.

[1]	[2]	[3]	[4]
14 yds.	y. qr. n.	4)4712 n.	4)47128
4	17 1 2	—	—
—	4	4)1178 qr.	4)11782
56 qr.	—	—	—
4	69 qr.	294 yds. 2qr.	12)2945 2qr.
—	4	—	—
224 n.	—	—	245 fms. 5 yds. 2 qr.
—	278 n.	—	—
[5]	[6]	[7]	[8]
4 fms.	10 bales.	4)7000 n.	42 ells.
14	10	—	5
—	—	5)1750 qr.	—
56 yds.	—	—	210 qr.
4	100 fms.	350 ells.	4
—	12	—	—
224 qr.	—	—	840 n.
4	1200 yds.	—	—
—	—	—	—
896 n.	—	—	—

## LAND MEASURE.

[1]	[2]	[3]	[5]
40 a.	a. r. p.	4,0)285,0 p.	
4	17 3 10	—	
—	4	4)71 10 p.	
160 r.	—	—	7 0
40	71 r.	—	10 0
—	40	—	12 1
6400 p.	—	—	—
—	2850 p.	—	29 1
—	—	—	4
[4]			
a. r.			
24 0			117
17 3			40
—			—
6 1			
4			
—			
25 r.			120
40			76
—			—
1000 p.			44
—			—

76)4680(61 shares and 44 perches over.

## LIQUID MEASURE.

[1]	[2]	[3]	[4]
17 gal.	10 bar.	4 bar.	72 hhd.
4	36	32	1½
<hr/>	<hr/>	<hr/>	<hr/>
68 qts.	360 gal.	128 gal.	72
2	4		36
<hr/>	<hr/>	<hr/>	<hr/>
136 pts.	1440 qts.		108 bar.
<hr/>	<hr/>		<hr/>

[5]	[6]
91 bar.	30 bar.
36	36
<hr/>	<hr/>
546	1080 gal.
273	
<hr/>	<hr/>
54)3276(60 hhd. 36 gal.	[7]
324	4 T.
<hr/>	4
36	<hr/>
<hr/>	16 hhd.
[8]	63
3 hhd.	<hr/>
63	1008 gal.
<hr/>	4
5)189	<hr/>
<hr/>	4032 qts.
	<hr/>

37 half anchors, and 4 gal.

[9]	pt.	[10]
63)1712(27 hhd. 11 gal.	1 pt. = 1	1 pipe.
126	1 qt. = 2	2
<hr/>	2 qts. = 4	<hr/>
452	7	2 hhd.
441		63
<hr/>		<hr/>
11		126 gal.
<hr/>		8
		<hr/>
		7)1008 pts.
		<hr/>
		144 of each.
		<hr/>

# REDUCTION.

31

## DRY MEASURE.

[1]	[2]	[3]	[4]
40 <i>grs.</i>	4)1280 <i>ft.</i>	30 <i>qt.</i>	4)7094
8	—	36	—
—	8)320 <i>bu.</i>	—	36)1773 2 <i>p.</i> (49 <i>ch.</i> 9 <i>bu.</i> 2 <i>p.</i>
320 <i>bu.</i>	—	1080 <i>bu.</i>	144
4	40 <i>grs.</i>	4	—
—	—	—	333
1280 <i>ft.</i>	—	4320 <i>ft.</i>	324
—	—	—	—
			9 <i>bu.</i>

## TIME.

[1]	[2]	[3]
6,0)12181,2 <i>sec.</i>	41 <i>w.</i>	6,0)41328,0
—	7	—
6,0)203,0 12 <i>sec.</i>	—	24)6888(7)287
—	287 <i>d.</i>	48
33 <i>p.</i> 50 <i>m.</i> 12 <i>sec.</i>	24	—
—	—	208
[4]	1148	192
365 <i>d.</i> 6 <i>b.</i>	574	—
24	—	168
—	6888 <i>hrs.</i>	168
1466	60	—
730	—	[5]
—	415280 <i>min.</i>	1781
8766 <i>hrs.</i>	—	365½
60	—	—
—	—	8908
525960 <i>m.</i>	—	10686
60	—	5343
—	—	445 6 <i>hrs.</i>
31557600 <i>sec.</i>	—	650510 <i>d.</i> 6 <i>h.</i>
—	—	—

	[6]	
March	30	MOTION.
April	30	6s.
May	31	30
June	30	
July	31	180°
August	31	60
September	30	
October	31	10800'
November	19	60
Ans. 263 days.		648000''

## RULE OF THREE DIRECT.

THE solution of many questions may be abbreviated by the following rules.

1. If the first term, and either the second or third, can be divided by any number, without a remainder, let them be divided, and the quotients used instead of them.

2. Divide the second term by the first, multiply the quotient by the third, and the product will be the answer.

3. Divide the third term by the first, multiply the quotient by the second, and the product will be the answer.

4. Divide the first term by the second, and the third by that quotient, the last quotient will be the answer.

5. Divide the first term by the third, and the second by that quotient, the last quotient will be the answer.

$$\begin{array}{rcl}
 & [1] & \\
 \text{oz.} & \text{s.} & \text{oz.} \\
 3 : 17 :: 48 & & \\
 *1 : 17 :: 16 & & \\
 16 & & 
 \end{array}$$

$$2,0)27,2$$

$$\text{£. } 13 \text{ } 12\text{s. } \text{Ans.}$$

\* This follows from Rule 1.

$$\begin{array}{rcl}
 & [2] & \\
 \text{lb.} & \text{s.} & \text{lb.} \\
 3 : 3 :: 26 & & \\
 \dagger 1 : 1 :: 26 & & \\
 & & 1
 \end{array}$$

$$20)26$$

$$\text{£. } 1 \text{ } 6\text{s. } \text{Ans.}$$

† Rule 1.



[3]  
*oz.*   *s. d.*   *lb.*  
 2 : 2 6 :: 7  
           16

          112  
 \*1 : 2 6 :: 56  
           7  
 -----  
 17 6  
       2

Ans. £. 7 0 0

[6]  
*lb.*   *d.*   *lb.*  
 1 : 4 :: 112  
           4

12)448

2,0)3,7 4d.

Ans. £. 1 17s. 4d.

[8]  
*gal.*   *d.*   *gal.*  
 1 : 4 :: 36  
           4

12)144

Ans. 12s.

[4]  
*gal.*   *d.*   *gal.*  
 8 : 8 :: 36  
           8

12)288

2,0)2,4

£. 1 4s. Ans.

[5]  
*lb.*   *d.*   *lb.*  
 1 : 4½ :: 48  
           4½

192

24

12)216

18s. Ans.

[7]  
*lb.*   *£.*   *s.*   *d.*   *lb.*  
 112 : 2 12 0 :: 1  
 \*14 : 0 6 6 :: 1  
 \*7 : 0 3 3 :: 1  
           1

7)0 8 3

Ans. 0 0 5½ + ¾

\* Rule 1.—By working the 7th and 15th examples, in the ordinary way, the learner will see the advantage of these rules.—In the following examples no references will be made.

## RULE OF THREE DIRECT.

[9]  
*pr. s. d. doz. pr.*

1 : 2 3 :: 19

12 12

—

27 228

27

1596

456

12)6156

2,0)51,3'

£. 25 13s. Ans.

[12]

*lb. d. lb.*

1 : 18 :: 336

18

12)6048

2,0)50,4

Ans. £. 25 4s.

[13]

*ch. £. s. d. ch.*

1 : 1 9 6 :: 19

19

£. 28 0 6 Ans.

[10]

*doz. pr. £. s. d. pr.*

19 : 25 13 0 :: 1

12

228

19 : 2 2 9 :: 1.

1

19)2 2 9

Ans. 0 2 3

[11]

*lb. s. d. lb.*

56 : 18 8 :: 1

7 : 2 4 :: 1

1

7)2 4

4d. Ans.

[14]

*lb. d. C. grs.*

1 : 9 :: 17 2

4

70

28

1960

9

12)17640

2,0)147,0

Ans. £. 73 10s.

[15]

oz. s. d. lb. oz. dwt. grs.

1 : 5 6 :: 1 10 10 4

20 12 12

20 66 22

24 20

480 450

24

1804

900

480 : 66 :: 10804

80 : 11 :: 10804

20 : 11 :: 2701

11

2,0)2971,1

12)1485 2qr.  $\frac{4}{20}$

2,0)12,3 9d.

£ 6 3s. 9d. 2qr.  $\frac{4}{20}$

[17]

y. s. fts.

1 : 14 :: 5

19

95

14

2,0)133,0

£. 66 10s. Ans.

[16]

lb. d. C. qr. lb.

1 : 15 :: 15 1 19

4

61

28

497

123

1727

15

12)25905

2,0)215,8 9d.

Ans. £ 107 18s. 9d.

[18]

E. s. d. fts.

1 : 4 6 :: 5

6 12

1 7 0 60

10

£. 13 10 0 Ans.

[19]

$$\begin{array}{rcl} d. & bu. & £. \\ 10 : 1 :: 100 & & \\ & & 20 \end{array}$$

$$\begin{array}{r} 2000 \\ 12 \\ \hline \end{array}$$

$$10)24000$$

$$\begin{array}{r} \text{bu. ch.} \\ 36)2400(66 \text{ 24 Ans.} \\ 216 \end{array}$$

$$\begin{array}{r} 240. \\ 216 \\ \hline \end{array}$$

$$24$$

[22]

$$\begin{array}{rcl} da. & d. & da. \\ 1 : 7 :: 365 & & \\ & & 7 \end{array}$$

$$12)2535$$

$$2,0)21,2 \text{ 11d.}$$

$$\text{Ans. £. 10 12s. 11d.}$$

[23]

$$\begin{array}{rcl} p. & d. & hhd. \\ 1 : 10 :: 3 & & \end{array}$$

$$62$$

$$189$$

$$8$$

$$1512$$

$$10$$

$$12)15120$$

$$2,0)126,0$$

$$\text{£. 63 Ans.}$$

[20]

$$\begin{array}{rcl} s. & bu. & gr. \\ 4 : 1 :: 40 & & \\ & & 21 \end{array}$$

$$4)840$$

$$8)210$$

$$\text{Ans. 26 gr. 2 bu.}$$

[21]

$$\begin{array}{rcl} da. & £. & da. \\ 365 : 300 :: 1 & & \\ & & 20 \end{array}$$

$$\begin{array}{rcl} s. & d. & \\ 365)6000(16 \text{ 5}\frac{1}{4} + \frac{15}{32} \text{ Ans.} \\ 365 \end{array}$$

$$2350$$

$$2190$$

$$160$$

$$12$$

$$1920$$

$$1025$$

$$95$$

$$4$$

$$380$$

$$365$$

$$15$$

[24]

<i>fife.</i>	<i>£.</i>	<i>ft.</i>
1	40	:: 1
2	20	
<hr/>		
2	800	
63	12	
<hr/>		
126	9600	$(9\frac{1}{2}d. + \frac{26}{1000})$ Ans.
8	9072	
<hr/>		
1008	528	
	4	
<hr/>		
	2112	
	2016	
<hr/>		

[27]

<i>ps.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>E.</i>
4	7	10	0	:: 1
12				
<hr/>				
48				
4	0	12	6	:: 1
			1	
<hr/>				
	4	0	12	6
		3	1	$\frac{1}{2}$ Ans.
<hr/>				
[29]				
<i>lb.</i>	<i>d.</i>	<i>C. gr.</i>		
1	1	$\frac{1}{2}$	:: 10	2
		4		
		42		
		28		
		336		
		84		
		1176		
		1	$\frac{1}{2}$	
		1176		
		588		
		12	1764	
		2,0	14,7	
<hr/>				

Ans. £ 7 7s.

[25]

<i>y.</i>	<i>s.</i>	<i>d.</i>	<i>ps.</i>
1	10	6	:: 12
		12	12
<hr/>			
	6	6	0
		12	144
<hr/>			
			£ 75 12 0 Ans.
<hr/>			

[26]

<i>y.</i>	<i>s.</i>	<i>y.</i>
1	3	:: 120
		3
<hr/>		
		2,0
		36,0
<hr/>		
		£ 18 Ans.

[28]

<i>C. gr. lb.</i>	
10 3 12	
26	
<hr/>	
10 2 14	
3	
<hr/>	

<i>lb.</i>	<i>d.</i>	<i>Ans.</i>
1	2	$\frac{1}{2}$ :: 31 3 14
		4
		127
		28
		1020
		255
		3570
		2
		7140
		1785
		12
		8925
		2,0
		74,3 9d.
<hr/>		
		Ans. £ 37 3s. 9d.

[30]

<i>h.</i>	<i>b.</i>	<i>h.</i>
6	: 21 ::	20
8	: 21 ::	10
1	: 7 ::	10

10

70 bush. Ans.

[32]

oz.	<i>s.</i>	oz.	<i>dwt.</i>
1	: 5 ::	36	10
20		20	
20		730	
		5	

2,0)365,0

20)18,2 6d.

An. £ 9 2s. 6d.

[34]

£.	<i>s. d.</i>	£.
1	: 12 6 ::	1000
	12	
	150	
	1000	

12)150000

2,0)1250,0

£ 625 Ans.

[31]

<i>f.</i>	<i>b.</i>	<i>f.</i>
10	: 3 ::	30
3	3	
30		

9 Ans.

[33]

<i>s. d.</i>	<i>y.</i>	£.
3 6	: 1 ::	100
12		20
42		2000
		12
		24000
7	: 1 ::	4000
		1

7)4000

An. 571  $\frac{3}{4}$  yds.

[35]

<i>s. d.</i>	oz.	<i>l.</i>	<i>s.</i>
5 4	: 1 ::	10	12
12		20	
64		212	
		12	

8)2544

8)318

Ans. 39oz. 15dwt.

[36]

*s.*     *y.*     *l.*     *s.*  
15 : 1 :: 16 10  
         20

15)330

Ans. 22yds.

[38]

*b.*     *s.*     *b.*  
36 : 33 :: 1

12

*d.*

36)396(11 Ans.

396

[40]

*£.*     *s.*

245 10

60 guis. = 63 00

*da.*

*da.*

365 : 182 10 :: 1

20

365)3650(10s. Ans.

3650

[41]

*C.*     *gr. lb.*     *£.*     *s.*     *d.*     *oz.*

17 3 17 : 133 13 4 :: 1

4

20

71

2673

28

12

575 32080)32080(1d. Ans.

143

32080

2905

16

32080

[37]

*lb.*     *s.*     *d.*     *lb.*  
112 : 37 4 :: 1  
14 : 4 8 :: 1  
7 : 2 4 :: 1

1

7)2 4

4 d. Ans.

[39]

*c.k.*     *s.*     *d.*     *c.k.*  
12 : 4 4 :: 49392

12

52

52

98784

246960

12)2568384

12)214032

2,0)1783,6

£.891 16s. Ans.

[42]

*C.*     *s.*     *d.*     *Foth.*

1 : 15 11 :: 5

12

19½

191

97½

97½

1337

1719

95½

12)18622½

2,0)155,1 10½

£.77 11 10½

[43]

<i>T.</i>		<i>£.</i>	<i>qt.</i>
-----------	--	-----------	------------

1	:	42	:: 1
---	---	----	------

4		20	
---	--	----	--

4		840
---	--	-----

63		12
----	--	----

252	1008	10080	(10 <i>d.</i> Ans.
-----	------	-------	--------------------

4		10080
---	--	-------

1008

[45]

<i>lb.</i>	<i>s. d.</i>	<i>C. gr. lb.</i>
------------	--------------	-------------------

14	:	8 6	:: 2 1 19
----	---	-----	-----------

12		4
----	--	---

102		9
-----	--	---

28
----

7	:	41	:: 271
---	---	----	--------

51
----

271
-----

1355
------

7	)	13821
---	---	-------

12	)	1974½ + ⅔
----	---	-----------

2,0	)	16,4 6
-----	---	--------

Ans. £.8	4	6½ + ⅔.
----------	---	---------

[48]

<i>y.</i>	<i>s.</i>	<i>fzs.</i>
-----------	-----------	-------------

1	:	18	:: 5
---	---	----	------

20
----

100
-----

18
----

2,0	)	180,0
-----	---	-------

Ans. £.90
-----------

[44]

<i>s. d.</i>	<i>w.</i>	<i>£.</i>
--------------	-----------	-----------

6 8	:	1	:: 50
-----	---	---	-------

12		20
----	--	----

80		1000
----	--	------

12
----

8,0	)	1200,0
-----	---	--------

4	)	150
---	---	-----

Ans. 37 <i>m.</i>	2 <i>w.</i>
-------------------	-------------

[46]

<i>lb.</i>	<i>d.</i>	<i>lb.</i>
------------	-----------	------------

1	:	3½	:: 112
---	---	----	--------

3½
----

336
-----

56
----

12	)	392
----	---	-----

2,0	)	3,2 8
-----	---	-------

£.1	12	8 Ans.
-----	----	--------

[47]

<i>y.</i>	<i>s.</i>	<i>fzs.</i>
-----------	-----------	-------------

1	:	12	:: 4
---	---	----	------

20
----

80
----

12
----

2,0	)	96,0
-----	---	------

£.48	Ans.
------	------



[49]

$$\begin{array}{l} \text{lb.} \quad d. \quad \text{lb.} \\ 1 : 1\frac{1}{2} :: 336 \\ \quad 1\frac{1}{2} \end{array}$$

$$\begin{array}{r} \hline 336 \\ 168 \\ \hline \end{array}$$

$$12)504$$

$$2,0)4,2$$

Ans. 6.2 2s.

[51]

$$14 = \frac{1}{8} \begin{array}{l} C. \text{ gr. lb.} \\ 17 \ 3 \ 12 \\ 2 \ 0 \ 26 \end{array}$$

$$\begin{array}{l} \text{lb.} \quad c. \\ 112 : 1125 :: 15 \ 2 \ 14 \\ \quad 4 \end{array}$$

$$\begin{array}{r} \hline 62 \\ 28 \\ \hline \end{array}$$

$$\begin{array}{r} \hline 500 \\ 125 \\ \hline \end{array}$$

$$112 : 1125 :: 1750$$

$$56 : 1125 :: 875$$

$$8 : 1125 :: 125$$

$$125$$

$$5625$$

$$13500$$

$$8)140625$$

Ans. \$ 175 78 $\frac{1}{2}$  c.

[50]

$$\begin{array}{l} \text{oz.} \quad d. \quad C. \\ 1 : 8\frac{1}{2} :: 6 \\ \quad 112 \end{array}$$

$$\begin{array}{r} \hline 672 \\ 16 \\ \hline \end{array}$$

$$10752$$

$$8\frac{1}{2}$$

$$86016$$

$$2688$$

$$12)88704$$

$$2,0)739,2$$

Ans. £.369 12s.

[52]

$$\begin{array}{l} y. \quad \$ \quad c. \quad y. \\ 12 : 9 \ 72 :: 56 \\ 1 : 81 :: 56 \end{array}$$

$$56$$

$$486$$

$$405$$

\$ 45 36 c. Ans.

[53]

$$\begin{array}{l} y. \quad \$ \quad c. \quad y. \\ 56 : 45 \ 36 :: 12 \\ 7 : 5 \ 67 :: 12 \\ 1 : 81 :: 12 \end{array}$$

$$12$$

\$ 9 72 c. Ans.

[54]

$\text{\$ c.} \quad y. \quad \text{\$ c.}$   
 $9 \ 72 : 12 :: 45 \ 36$   
 $81 : 1 :: 45 \ 36$   
 $9 : 1 :: 5 \ 04$   
 $\quad \quad \quad 1$

---

9)504

---

Ans. 56 yds.

[56]

$lb. \quad c. \quad C. \ gr. \ lb.$   
 $1 : 13 :: 7 \ 3 \ 10$

---

4

---

31

---

28

---

248

---

63

---

878

---

13

---

Ans.  $\text{\$} \ 114 \ 14 \ c.$

[58]

$y. \quad c. \quad y. \ gr. \ n.$

$1 : 875 :: 17 \ 3 \ 2$

---

4

---

4

---

4

---

16 : 875 :: 286

---

8 : 875 :: 143

---

143

---

2625

---

3500

---

875

---

9)125125

---

Ans.  $\text{\$} \ 156 \ 40\frac{1}{2} \ c.$

[55]

$c. \quad y. \quad \text{\$}$   
 $27 : 1 :: 22$

---

100

---

yds.

---

27)2200(81 $\frac{1}{2}$  Ans.

---

216

---

40

---

27

[57]

$lb. \quad c. \quad C. \ gr. \ lb.$   
 $112 : 1050 :: 7 \ 3 \ 10$

---

4

---

31

---

28

---

248

---

63

---

878

---

1050

---

43900

---

878

---

7)112|921900

---

4)16|131700

---

4| 32925

---

$\text{\$} \ 82 \ 31\frac{1}{2} \ c. \text{ Ans.}$

[59]

<i>fl.</i>	<i>§</i>	<i>a. r. fl.</i>
160 :	35 ::	7 2 25
	100	4
	<hr/>	
	3500	30
		40

8 : 175 :: 1225

175

6125

8575

1225

8)214375

Ans. § 267 96 $\frac{1}{8}$  c.

[60]

<i>oz.</i>	<i>c.</i>	<i>lb. oz. dwt.</i>
1 :	90 ::	7 10 14
20		12
<hr/>		
20		94
		20

2 : 9 :: 1894

9

2)17046

Ans. § 85 23 c.

INVERSE PROPORTION.

[1]

<i>M.</i>	<i>d.</i>	<i>M.</i>
48 :	24 ::	192
	48	
	<hr/>	
	192	
	96	

men.

192)1152(6 Ans.

1152

[3]

<i>M.</i>	<i>£.</i>	<i>M.</i>
12 :	100 ::	8
	12	
	<hr/>	
	8)1200	
	<hr/>	
	£ 150	Ans.

[4]

<i>h.</i>	<i>d.</i>	<i>h.</i>
16 :	3 ::	12
	16	
	<hr/>	
	12)48	
	<hr/>	
	Ans. 4 days.	

[2]

<i>£.</i>	<i>M.</i>	<i>£.</i>
100 :	6 ::	1000
	30	
	<hr/>	
	180	
	100	

1,000)18,000

Ans. 18 days.

[5]

<i>ft.</i>	<i>ft.</i>	<i>f. i.</i>
18 :	30 ::	1 6
	12	12
	<hr/>	
	360	18
	18	

3)18)6480

6)2160

3)360

Ans. 120 yards.

## INVERSE PROPORTION.

$$\begin{array}{r} [6] \\ C. \quad M. \quad C. \\ 1 : 150 :: 6 \\ \hline 1 \end{array}$$

$$6)150$$

Ans. 25 *miles*.

$$\begin{array}{r} [7] \\ in. \quad in. \quad in. \\ 12 : 12 :: 3 \\ \hline 12 \end{array}$$

$$3)144$$

Ans. 48 *inches*.

$$\begin{array}{r} [8] \\ f. \quad m. \quad f. \\ 12 : 46 : 8 \\ \hline 12 \end{array}$$

$$8)552$$

Ans. 69 *men*.

$$\begin{array}{r} [9] \\ s. d., oz. \quad s. d. \\ 6 \ 3 : 9 :: 4 \ 6 \\ \hline 12 \quad 12 \\ \hline 75 \quad 54 \\ 9 \end{array}$$

54)675(12 oz. 10 dwt. Ans.

$$648$$

$$27$$

$$20$$

$$540$$

$$540$$

$$[12]$$

mo. men. mo.

$$8 : 120 :: 2$$

$$8$$

$$2)960$$

Ans. 480 *men*.

$$\begin{array}{r} [10] \\ mo. \quad men. \quad mo. \\ 2 : 800 :: 5 \\ \hline 2 \end{array}$$

$$5)1600$$

320 *must stay*

Ans. 480 *must go*

$$\begin{array}{r} [11] \\ h. \quad c. \quad m. \\ 12 : 1 :: 15 \\ \hline 60 \end{array}$$

cocks.

15)720(48 Ans.

$$60$$

$$120$$

$$120$$

# PRACTICE.

## PRACTICE.

45

### Case 1.

$$\begin{array}{r}
 \frac{1}{4} \quad \frac{1}{4} \quad 7 \ 6 \ 1 \ 2 \text{ at } \frac{1}{4} \\
 \hline
 12 \quad 1 \ 9 \ 0 \ 3 \\
 \hline
 2,0 \quad 1 \ 5,8 \ 7 \\
 \hline
 \text{£. } 7 \ 18s. \ 7d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \frac{1}{2} \quad \frac{1}{4} \quad 1 \ 2 \ 8 \ 0 \text{ at } \frac{1}{4} \\
 \hline
 12 \quad 3 \ 2 \ 0 \\
 \hline
 2,0 \quad 2,6 \ 8 \\
 \hline
 \text{£. } 1 \ 6s. \ 8d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \frac{1}{2} \quad \frac{1}{2} \quad 6 \ 8 \ 1 \ 2 \text{ at } \frac{1}{2} \\
 \hline
 12 \quad 3 \ 4 \ 0 \ 6 \\
 \hline
 2,0 \quad 2 \ 8,3 \ 10 \\
 \hline
 \text{£. } 14 \ 3s. \ 10d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \frac{1}{2} \quad \frac{1}{2} \quad 7 \ 6 \ 7 \ 2 \text{ at } \frac{1}{2} \\
 \hline
 12 \quad 3 \ 8 \ 3 \ 6 \\
 \hline
 2,0 \quad 3 \ 1,9 \ 8 \\
 \hline
 \text{£. } 15 \ 19s. \ 8d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \frac{1}{2} \quad \frac{1}{2} \quad 4 \ 7 \ 1 \ 2 \text{ at } \frac{3}{4} \\
 \hline
 \frac{1}{4} \quad \frac{1}{2} \quad 2 \ 3 \ 5 \ 6 \\
 1 \ 1 \ 7 \ 8 \\
 \hline
 12 \quad 3 \ 5 \ 3 \ 4 \\
 \hline
 2,0 \quad 2 \ 9,4 \ 6 \\
 \hline
 \text{£. } 14 \ 14s. \ 6d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \frac{1}{2} \quad \frac{1}{2} \quad 9 \ 1 \ 8 \ 0 \text{ at } \frac{3}{4} \\
 \hline
 \frac{1}{4} \quad \frac{1}{2} \quad 4 \ 5 \ 9 \ 0 \\
 2 \ 2 \ 9 \ 5 \\
 \hline
 12 \quad 6 \ 8 \ 8 \ 5 \\
 \hline
 2,0 \quad 5 \ 7,3 \ 9 \\
 \hline
 \text{£. } 28 \ 13s. \ 9d. \text{ Ans.}
 \end{array}$$

### Case 2.

$$\begin{array}{r}
 1 \quad \frac{1}{12} \quad 7 \ 6 \ 1 \ 2 \text{ at } 1d. \\
 \hline
 2,0 \quad 6 \ 3,4 \ 4 \\
 \hline
 \text{£. } 31 \ 14s. \ 4d. \text{ Ans.}
 \end{array}$$
  

$$\begin{array}{r}
 1 \quad \frac{1}{12} \quad 8 \ 6 \ 1 \ 2 \text{ at } 1\frac{1}{4}d. \\
 \hline
 \frac{1}{4} \quad \frac{1}{4} \quad 7 \ 1 \ 7 \ 8 \\
 1 \ 7 \ 9 \ 5 \\
 \hline
 2,0 \quad 8 \ 9,7 \ 1 \\
 \hline
 \text{£. } 44 \ 17s. \ 1d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 1 \quad \frac{1}{12} \quad 6 \ 8 \ 1 \ 2 \text{ at } 1d. \\
 \hline
 2,0 \quad 5 \ 6,7 \ 8 \\
 \hline
 \text{£. } 28 \ 7s. \ 8d. \text{ Ans.}
 \end{array}$$
  

$$\begin{array}{r}
 1 \quad \frac{1}{12} \quad 1 \ 8 \ 6 \ 1 \text{ at } 1\frac{1}{4}d. \\
 \hline
 \frac{1}{4} \quad \frac{1}{4} \quad 1 \ 5 \ 5 \ 1 \\
 3 \ 8 \ 9\frac{3}{4} \\
 \hline
 2,0 \quad 1 \ 9,3 \ 10\frac{1}{4} \\
 \hline
 \text{£. } 9 \ 13s. \ 10\frac{1}{4} \text{ Ans.}
 \end{array}$$

$$1\frac{1}{2} \quad \frac{1}{8} \quad 4 \ 1 \ 2 \ 1 \text{ at } 1\frac{1}{2}d.$$

$$2,0 \quad \begin{array}{r} 5 \ 1,5 \ 1\frac{1}{2} \end{array}$$

$$\text{£.25 } 15s. \ 1\frac{1}{2}d. \text{ Ans.}$$

$$1\frac{1}{2} \quad \frac{1}{8} \quad 1 \ 8 \ 6 \ 1 \text{ at } 1\frac{1}{2}d.$$

$$\frac{1}{4} \quad \frac{1}{8} \quad \begin{array}{r} 2 \ 3 \ 2 \ 7\frac{1}{2} \\ 3 \cdot 8 \ 9\frac{1}{4} \end{array}$$

$$2,0 \quad \begin{array}{r} 2 \ 7,1 \ 4\frac{1}{2} \end{array}$$

$$\text{£.13 } 11s. \ 4\frac{1}{2}d. \text{ Ans.}$$

$$2 \quad \frac{1}{8} \quad 4 \ 7 \ 6 \ 1 \text{ at } 2d.$$

$$2,0 \quad \begin{array}{r} 7 \ 9,3 \ 6 \end{array}$$

$$\text{£. } 39 \ 13s. \ 6d. \text{ Ans.}$$

$$2 \quad \frac{1}{8} \quad 6 \ 1 \ 8 \ 1 \text{ at } 2\frac{1}{2}d.$$

$$\frac{1}{4} \quad \frac{1}{8} \quad \begin{array}{r} 1 \ 0 \ 3 \ 0 \ 2 \\ 1 \ 2 \ 8 \ 9\frac{1}{4} \end{array}$$

$$2,0 \quad \begin{array}{r} 1 \ 1 \ 5,8 \ 11\frac{1}{2} \end{array}$$

$$\text{£.57 } 18s. \ 11\frac{1}{2}d. \text{ Ans.}$$

$$2 \quad \frac{1}{8} \quad 1 \ 2 \ 1 \ 8 \text{ at } 2\frac{1}{2}d.$$

$$\frac{1}{2} \quad \frac{1}{4} \quad \begin{array}{r} 2 \ 0 \ 3 \\ 5 \ 0 \ 9 \end{array}$$

$$2,0 \quad \begin{array}{r} 2 \ 5,3 \ 9 \end{array}$$

$$\text{£. } 12 \ 13s. \ 9d. \text{ Ans.}$$

$$2 \quad \frac{1}{8} \quad 8 \ 0 \ 1 \ 2 \text{ at } 2\frac{1}{2}d.$$

$$\frac{1}{2} \quad \frac{1}{4} \quad \frac{1}{2} \quad \begin{array}{r} 1 \ 3 \ 3 \ 5 \ 4 \\ 3 \ 3 \ 3 \ 10 \\ 1 \ 6 \ 6 \ 11 \end{array}$$

$$2,0 \quad \begin{array}{r} 1 \ 8 \ 3,6 \ 1 \end{array}$$

$$\text{£.91 } 16s. \ 1d. \text{ Ans.}$$

$$3 \quad \frac{1}{4} \quad 7 \ 6 \ 1 \ 2 \text{ at } 3d.$$

$$2,0 \quad \begin{array}{r} 1 \ 9 \ 0,3 \end{array}$$

$$\text{£.95 } 3s. \text{ Ans.}$$

$$3 \quad \frac{1}{4} \quad 6 \ 1 \ 2 \ 8 \text{ at } 3\frac{1}{2}d.$$

$$\frac{1}{4} \quad \frac{1}{12} \quad \begin{array}{r} 1 \ 5 \ 3 \ 2 \\ 1 \ 2 \ 7 \ 8 \end{array}$$

$$2,0 \quad \begin{array}{r} 1 \ 6 \ 5,9 \ 8 \end{array}$$

$$\text{£.82 } 19s. \ 8d. \text{ Ans.}$$

$$3 \quad \frac{1}{4} \quad 6 \ 1 \ 8 \ 0 \text{ at } 3\frac{1}{2}d.$$

$$\frac{1}{2} \quad \frac{1}{8} \quad \begin{array}{r} 1 \ 5 \ 4 \ 5 \\ 2 \ 5 \ 7 \ 6 \end{array}$$

$$2,0 \quad \begin{array}{r} 1 \ 8 \ 0,2 \ 6 \end{array}$$

$$\text{£.90 } 2s. \ 6d. \text{ Ans.}$$

$$3 \quad \frac{1}{4} \quad 7 \ 8 \ 1 \ 2 \text{ at } 3\frac{1}{2}d.$$

$$\frac{1}{4} \quad \frac{1}{4} \quad \begin{array}{r} 1 \ 9 \ 5 \ 3 \\ 4 \ 8 \ 8 \ 3 \end{array}$$

$$2,0 \quad \begin{array}{r} 2 \ 4 \ 4,1 \ 3 \end{array}$$

$$\text{£.122 } 1s. \ 3d. \text{ Ans.}$$

$$\begin{array}{r}
 4 \quad \frac{1}{3} \quad 8 \ 1 \ 2 \ 0 \text{ at } 4d. \\
 \hline
 2,0 \quad 2 \ 7 \ 0,6 \ 8 \\
 \hline
 \text{£.135 } 6s. \ 8d. \text{ Ans.}
 \end{array}$$

$$4 \quad \frac{1}{3} \quad 7 \ 0 \ 0 \ 0 \text{ at } 4\frac{1}{2}d.$$

$$\begin{array}{r}
 \frac{1}{4} \quad \frac{1}{16} \quad 2 \ 3 \ 3 \ 3 \ 4 \\
 \quad \quad \quad 1 \ 4 \ 5 \ 10 \\
 \hline
 2,0 \quad 2 \ 4 \ 7,9 \ 2 \\
 \hline
 \text{£.123 } 19s. \ 2d. \text{ Ans.}
 \end{array}$$

$$4 \quad \frac{1}{3} \quad 6 \ 0 \ 0 \ 1 \text{ at } 4\frac{1}{2}d.$$

$$\begin{array}{r}
 \frac{1}{2} \quad \frac{1}{8} \quad 2 \ 0 \ 0 \ 0 \ 4 \\
 \quad \quad \quad 2 \ 5 \ 0 \ 0\frac{1}{2} \\
 \hline
 2,0 \quad 2 \ 2 \ 5,0 \ 4\frac{1}{2} \\
 \hline
 \text{£.112 } 10s. \ 4\frac{1}{2}d. \text{ Ans.}
 \end{array}$$

$$4 \quad \frac{1}{3} \quad 7 \ 1 \ 2 \ 1 \text{ at } 4\frac{1}{2}d.$$

$$\begin{array}{r}
 \frac{1}{2} \quad \frac{1}{8} \quad 2 \ 3 \ 7 \ 3 \ 8 \\
 \quad \quad \quad 2 \ 9 \ 6 \ 8\frac{1}{2} \\
 \quad \quad \quad 1 \ 4 \ 8 \ 4\frac{1}{2} \\
 \hline
 2,0 \quad 2 \ 8 \ 1,8 \ 8\frac{1}{2} \\
 \hline
 \text{£.140 } 18s. \ 8\frac{1}{2}d. \text{ Ans.}
 \end{array}$$

$$4 \quad \frac{1}{3} \quad 7 \ 1 \ 8 \ 1 \text{ at } 5d.$$

$$\begin{array}{r}
 1 \quad \frac{1}{4} \quad 2 \ 3 \ 9 \ 3 \ 8 \\
 \quad \quad \quad 5 \ 9 \ 8 \ 5 \\
 \hline
 2,0 \quad 2 \ 9 \ 9,2 \ 1 \\
 \hline
 \text{£.149 } 12s. \ 1d. \text{ Ans.}
 \end{array}$$

$$4 \quad \frac{1}{3} \quad 8 \ 1 \ 2 \ 1 \text{ at } 5\frac{1}{2}d.$$

$$\begin{array}{r}
 1 \quad \frac{1}{4} \quad 2 \ 7 \ 0 \ 7 \\
 \frac{1}{2} \quad \frac{1}{4} \quad \quad 6 \ 7 \ 6 \ 9 \\
 \quad \quad \quad 1 \ 6 \ 9 \ 2\frac{1}{2}
 \end{array}$$

$$2,0 \quad 3 \ 5 \ 5,2 \ 11\frac{1}{2}$$

$$\text{£.177 } 12s. \ 11\frac{1}{2}d. \text{ Ans.}$$

$$4 \quad \frac{1}{3} \quad 6 \ 1 \ 2 \ 8 \text{ at } 5\frac{1}{2}d.$$

$$\begin{array}{r}
 1\frac{1}{2} \quad \frac{1}{8} \quad 2 \ 0 \ 4 \ 2 \ 8 \\
 \quad \quad \quad 7 \ 6 \ 6 \ 0
 \end{array}$$

$$2,0 \quad 2 \ 8 \ 0,8 \ 8$$

$$\text{£.140 } 8s. \ 8d. \text{ Ans.}$$

$$4 \quad \frac{1}{3} \quad 6 \ 1 \ 0 \ 0 \text{ at } 5\frac{1}{2}d.$$

$$\begin{array}{r}
 1\frac{1}{2} \quad \frac{1}{8} \quad 2 \ 0 \ 3 \ 3 \ 4 \\
 \frac{1}{4} \quad \frac{1}{8} \quad \quad 7 \ 6 \ 2 \ 6 \\
 \quad \quad \quad 1 \ 2 \ 7 \ 1
 \end{array}$$

$$2,0 \quad 2 \ 9 \ 2,2 \ 11$$

$$\text{£.146 } 2s. \ 11d. \text{ Ans.}$$

$$6 \quad \frac{1}{2} \quad 1 \ 0 \ 0 \ 0 \text{ at } 6d.$$

$$2,0 \quad 5 \ 0,0$$

$$\text{£.25 Ans.}$$

$$6 \quad \frac{1}{2} \quad 7 \ 6 \ 1 \ 0 \text{ at } 6\frac{1}{2}d.$$

$$\begin{array}{r}
 \frac{1}{4} \quad \frac{1}{24} \quad 3 \ 8 \ 0 \ 5 \\
 \quad \quad \quad 1 \ 5 \ 8 \ 6\frac{1}{2}
 \end{array}$$

$$2,0 \quad 3 \ 9 \ 6,3 \ 6\frac{1}{2}$$

$$\text{£.198 } 3s. \ 6\frac{1}{2}d. \text{ Ans.}$$

$$\begin{array}{r}
 6 \quad \frac{1}{2} \quad 1 \ 2 \ 1 \ 8 \text{ at } 6\frac{1}{2}d. \\
 \hline
 \frac{1}{12} \quad 6 \ 0 \ 9 \\
 \quad \quad 5 \ 0 \ 9 \\
 \hline
 2,0 \quad 6 \ 5,9 \ 9 \\
 \hline
 32l. \ 19s. \ 9d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 6 \quad \frac{1}{2} \quad 6 \ 0 \ 0 \ 0 \text{ at } 6\frac{1}{2}d. \\
 \hline
 \frac{1}{8} \quad 3 \ 0 \ 0 \ 0 \\
 \quad \quad 3 \ 7 \ 5 \\
 \hline
 2,0 \quad 3 \ 3 \ 7,5 \\
 \hline
 168l. \ 15s. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 6 \quad \frac{1}{2} \quad 7 \ 1 \ 0 \ 1 \text{ at } 7d. \\
 \hline
 1 \quad \frac{1}{6} \quad 3 \ 5 \ 5 \ 0 \ 6 \\
 \quad \quad 5 \ 9 \ 1 \ 9 \\
 \hline
 2,0 \quad 4 \ 1 \ 4,2 \ 3 \\
 \hline
 207l. \ 2s. \ 3d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 6 \quad \frac{1}{3} \quad 1 \ 0 \ 0 \ 1 \text{ at } 7\frac{1}{2}d. \\
 \hline
 1 \quad \frac{1}{6} \quad 5 \ 0 \ 0 \ 6 \\
 \frac{1}{4} \quad \frac{1}{4} \quad 8 \ 3 \ 5 \\
 \quad \quad 2 \ 0 \ 10\frac{1}{2} \\
 \hline
 2,0 \quad 6 \ 0,4 \ 9\frac{1}{2} \\
 \hline
 30l. \ 4s. \ 9\frac{1}{2}d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 6 \quad \frac{1}{2} \quad 4 \ 1 \ 0 \ 0 \text{ at } 7\frac{1}{2}d. \\
 \hline
 1\frac{1}{2} \quad \frac{1}{4} \quad 2 \ 0 \ 5 \ 0 \\
 \quad \quad 5 \ 1 \ 2 \ 6 \\
 \hline
 2,0 \quad 2 \ 5 \ 6,2 \ 6 \\
 \hline
 128l. \ 2s. \ 6d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 6 \quad \frac{1}{2} \quad 6 \ 1 \ 2 \ 0 \text{ at } 7\frac{1}{2}d. \\
 \hline
 1\frac{1}{2} \quad \frac{1}{4} \quad 3 \ 0 \ 6 \ 0 \\
 \frac{1}{4} \quad \frac{1}{8} \quad 7 \ 6 \ 5 \\
 \quad \quad 1 \ 2 \ 7 \ 6 \\
 \hline
 2,0 \quad 3 \ 9 \ 5,2 \ 6 \\
 \hline
 197l. \ 12s. \ 6d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 6 \quad \frac{1}{2} \quad 7 \ 1 \ 0 \ 0 \text{ at } 8d. \\
 \hline
 2 \quad \frac{1}{3} \quad 3 \ 5 \ 5 \ 0 \\
 \quad \quad 1 \ 1 \ 8 \ 3 \ 4 \\
 \hline
 2,0 \quad 4 \ 7 \ 3,3 \ 4 \\
 \hline
 236l. \ 13s. \ 4d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 6 \quad \frac{1}{2} \quad 6 \ 1 \ 0 \ 0 \text{ at } 8\frac{1}{2}d. \\
 \hline
 2 \quad \frac{1}{3} \quad 3 \ 0 \ 5 \ 0 \\
 \frac{1}{4} \quad \frac{1}{8} \quad 1 \ 0 \ 1 \ 6 \ 8 \\
 \quad \quad 1 \ 2 \ 7 \ 1 \\
 \hline
 2,0 \quad 4 \ 1 \ 9,3 \ 9 \\
 \hline
 209l. \ 13s. \ 9d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 6 \quad \frac{1}{2} \quad 8 \ 0 \ 0 \ 0 \text{ at } 8\frac{1}{2}d. \\
 \hline
 2 \quad \frac{1}{3} \quad 4 \ 0 \ 0 \ 0 \\
 \frac{1}{4} \quad \frac{1}{4} \quad 1 \ 3 \ 3 \ 3 \ 4 \\
 \quad \quad 3 \ 3 \ 3 \ 4 \\
 \hline
 2,0 \quad 5 \ 6 \ 6,6 \ 8 \\
 \hline
 289l. \ 6s. \ 8d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 6 \quad \frac{1}{2} \quad 6 \ 0 \ 0 \ 0 \text{ at } 8\frac{1}{2}d. \\
 \hline
 2 \quad \frac{1}{3} \quad 3 \ 0 \ 0 \ 0 \\
 \frac{1}{4} \quad \frac{1}{4} \quad 1 \ 0 \ 0 \ 0 \\
 \frac{1}{4} \quad \frac{1}{4} \quad 2 \ 5 \ 0 \\
 \quad \quad 1 \ 2 \ 5 \\
 \hline
 2,0 \quad 4 \ 3 \ 7,5 \\
 \hline
 218l. \ 15s. \text{ Ans.}
 \end{array}$$



$$\begin{array}{r} 6 \quad \frac{1}{2} \quad 9 \ 0 \ 0 \ 0 \text{ at } 9d. \\ \hline \end{array}$$

$$\begin{array}{r} 3 \quad \frac{1}{2} \quad 4 \ 5 \ 0 \ 0 \\ 2 \ 2 \ 5 \ 0 \\ \hline \end{array}$$

$$2,0 \quad 6 \ 7 \ 5,0$$

$$\text{£.337 } 10s. \text{ Ans.}$$

$$6 \quad \frac{1}{2} \quad 4 \ 1 \ 2 \ 1 \text{ at } 9\frac{1}{2}d.$$

$$\begin{array}{r} 3 \quad \frac{1}{2} \quad 2 \ 0 \ 6 \ 0 \ 6 \\ \frac{1}{4} \quad \frac{1}{12} \quad 1 \ 0 \ 3 \ 0 \ 3 \\ \hline 8 \ 5 \ 10\frac{1}{2} \end{array}$$

$$2,0 \quad 3 \ 1 \ 7,6 \ 7\frac{1}{2}$$

$$\text{£.158 } 16s. \ 7\frac{1}{2}d. \text{ Ans.}$$

$$6 \quad \frac{1}{2} \quad 6 \ 1 \ 0 \ 0 \text{ at } 9\frac{1}{2}d.$$

$$\begin{array}{r} 3 \quad \frac{1}{2} \quad 3 \ 0 \ 5 \ 0 \\ \frac{1}{4} \quad \frac{1}{8} \quad 1 \ 5 \ 2 \ 5 \\ \hline 2 \ 5 \ 4 \ 2 \end{array}$$

$$2,0 \quad 4 \ 8 \ 2,9 \ 2$$

$$\text{£.241 } 9s. \ 2d. \text{ Ans.}$$

$$6 \quad \frac{1}{2} \quad 5 \ 9 \ 1 \ 8 \text{ at } 9\frac{1}{2}d.$$

$$\begin{array}{r} 3 \quad \frac{1}{2} \quad 2 \ 9 \ 5 \ 9 \\ \frac{1}{4} \quad \frac{1}{4} \quad 1 \ 4 \ 7 \ 9 \ 6 \\ \hline 3 \ 6 \ 9 \ 10\frac{1}{2} \end{array}$$

$$2,0 \quad 4 \ 8 \ 0,8 \ 4\frac{1}{2}$$

$$\text{£.240 } 8s. \ 4\frac{1}{2}d. \text{ Ans.}$$

$$\begin{array}{r} 8 \ 1 \ 2 \ 1 \text{ at } 10d.* \\ 12 \ 8 \ 1 \ 2 \ 1,0 \end{array}$$

$$2,0 \quad 6 \ 7 \ 6,7 \ 6$$

$$\text{£.338 } 7s. \ 6d. \text{ Ans.}$$

$$\begin{array}{r} \frac{1}{2} \quad \frac{1}{2} \quad 6 \ 7 \ 1 \ 2 \text{ at } 10\frac{1}{2}d.* \\ \hline \end{array}$$

$$\begin{array}{r} 6 \ 7 \ 1 \ 2 \ 0 \\ 1 \ 6 \ 7 \ 8 \\ \hline \end{array}$$

$$12 \quad 6 \ 8 \ 7 \ 9 \ 8$$

$$2,0 \quad 5 \ 7 \ 3,3 \ 2$$

$$\text{£.286 } 13s \ 2d. \text{ Ans.}$$

$$6 \quad \frac{1}{2} \quad 1 \ 0 \ 0 \ 2 \text{ at } 10\frac{1}{2}d.$$

$$\begin{array}{r} 4 \quad \frac{1}{4} \quad 5 \ 0 \ 1 \\ \frac{1}{2} \quad \frac{1}{8} \quad 3 \ 3 \ 4 \\ \hline 4 \ 1 \ 9 \end{array}$$

$$2,0 \quad 8 \ 7,6 \ 9$$

$$\text{£.43 } 16s. \ 9d. \text{ Ans.}$$

$$6 \quad \frac{1}{2} \quad 4 \ 6 \ 8 \ 0 \text{ at } 10\frac{1}{2}d.$$

$$\begin{array}{r} 4 \quad \frac{1}{4} \quad 2 \ 3 \ 4 \ 0 \\ \frac{1}{2} \quad \frac{1}{8} \quad 1 \ 5 \ 6 \ 0 \\ \frac{1}{4} \quad \frac{1}{4} \quad 1 \ 9 \ 5 \\ \hline 9 \ 7 \ 6 \end{array}$$

$$2,0 \quad 4 \ 1 \ 9,2 \ 6$$

$$\text{£.209 } 12s. \ 6d. \text{ Ans.}$$

$$6 \quad \frac{1}{2} \quad 1 \ 2 \ 6 \ 0 \text{ at } 11d.$$

$$\begin{array}{r} 4 \quad \frac{1}{4} \quad 6 \ 3 \ 0 \\ 1 \quad \frac{1}{4} \quad 4 \ 2 \ 0 \\ \hline 1 \ 0 \ 5 \end{array}$$

$$2,0 \quad 1 \ 1 \ 5,5$$

$$\text{£.57 } 15s. \text{ Ans.}$$

\* Note. Annexing a cipher is multiplying by 10. In a similar manner might the 7 following be wrought.

6	$\frac{1}{2}$	6 1 2 1 at $11\frac{1}{2}d.$
4	$\frac{1}{4}$	3 0 6 9 6
1	$\frac{1}{2}$	2 0 4 0 4
$\frac{1}{4}$	$\frac{1}{4}$	5 1 0 1
		1 2 7 6 $\frac{1}{2}$
2,0		5 7 3, 8 5 $\frac{1}{2}$
		£.286 18s. 5 $\frac{1}{2}d.$ Ans.
6	$\frac{1}{2}$	1 2 3 4 at $11\frac{1}{2}d.$
4	$\frac{1}{4}$	6 1 7
$1\frac{1}{2}$	$\frac{1}{8}$	4 1 1 4
		1 5 4 3
2,0		1 1 8, 2 7
		£.59 2s. 7d. Ans.

6	$\frac{1}{2}$	2 3 4 5 at $11\frac{1}{2}d.$
4	$\frac{1}{4}$	1 1 7 2 6
$1\frac{1}{2}$	$\frac{1}{8}$	7 8 1 8
$\frac{1}{4}$	$\frac{1}{8}$	2 9 3 1 $\frac{1}{2}$
		4 8 10 $\frac{1}{2}$
2,0		2 2 9, 6 1 $\frac{1}{2}$
		£.114 16s. 1 $\frac{1}{2}d.$ Ans.
6	$\frac{1}{2}$	1 0 0 at $11\frac{1}{2}d.$
3	$\frac{1}{4}$	5 0
$1\frac{1}{2}$	$\frac{1}{8}$	2 5
$\frac{1}{4}$	$\frac{1}{8}$	1 2 6
	$\frac{1}{8}$	6 3
	$\frac{1}{8}$	4 2
2,0		9, 7 11
		£.4 17s. 11d. Ans.

## Case 3.

$\frac{1}{2}$	$\frac{1}{4}$	4 8 6 at $12\frac{1}{2}d.$
		12 1 2 1 $\frac{1}{2}$
		1 0 1 $\frac{1}{2}$
2,0		4 9, 6 1 $\frac{1}{2}$
		£.24 16s. 1 $\frac{1}{2}d.$ Ans.
$\frac{1}{2}$	$\frac{1}{2}$	4 8 6 at $12\frac{1}{2}d.$
		12 2 4 3
		2 0 3
2,0		5 0, 6 3
		£.25 6s. 3d. Ans.

$\frac{1}{4}$	$\frac{1}{2}$	7 6 1 2 at $12\frac{1}{2}d.$
		12 1 9 0 3
		1 5 8 7
2,0		7 7 7, 0 7
		£.388 10s. 7d. Ans.
$\frac{1}{2}$	$\frac{1}{2}$	1 2 1 6 at $12\frac{1}{2}d.$
		12 6 0 8
		5 0 8
2,0		1 2 6, 6 8
		£.63 6s. 8d. Ans.

$\frac{1}{2}$	$\frac{1}{18}$	1 2 1 6 at $12\frac{1}{2}d.$ 7 6 <hr/> 2,0 1 2 9, 2 <hr/> £.64 12s. Ans.	2	$\frac{1}{8}$	1 2 7 1 at $14\frac{1}{2}d.$ 2 1 1 10 2 6 5 $\frac{1}{2}$ <hr/> 2,0 1 5 0, 9 3 $\frac{1}{2}$ <hr/> £.75 9s. $3\frac{1}{2}d.$ Ans.
1	$\frac{1}{18}$	6 1 2 1 at $13d.$ 5 1 0 1 <hr/> 2,0 6 6 3, 1 1 <hr/> £.331 11s. 1d. Ans.	2	$\frac{1}{8}$	6 1 2 0 at $14\frac{1}{2}d.$ 1 0 2 0 2 5 5 <hr/> 2,0 7 3 9, 5 <hr/> £.369 15s. Ans.
$\frac{1}{4}$	$\frac{1}{18}$	1 2 8 1 at $13\frac{1}{2}d.$ 1 0 6 9 2 6 8 $\frac{1}{2}$ <hr/> 2,0 1 4 1, 4 5 $\frac{1}{2}$ <hr/> £.70 14s. $5\frac{1}{2}d.$ Ans.	2	$\frac{1}{8}$	1 2 1 0 at $14\frac{1}{2}d.$ 2 0 1 8 7 5 7 $\frac{1}{2}$ <hr/> 2,0 1 4 8, 7 3 $\frac{1}{2}$ <hr/> £.74 7s. $3\frac{1}{2}d.$ Ans.
$\frac{1}{2}$	$\frac{1}{8}$	6 1 0 0 at $13\frac{1}{2}d.$ 7 6 2 6 <hr/> 2,0 6 8 6, 2 6 <hr/> £.343 2s. 6d. Ans.	3	$\frac{1}{8}$	1 2 6 0 at $15d.$ 3 1 5 <hr/> 2,0 1 5 7, 5 <hr/> £.78 15s. Ans.
$\frac{1}{4}$	$\frac{1}{8}$	1 2 1 0 at $13\frac{1}{2}d.$ 1 5 1 3 2 5 2 $\frac{1}{2}$ <hr/> 2,0 1 3 8, 6 5 $\frac{1}{2}$ <hr/> £.69 6s. $5\frac{1}{2}d.$ Ans.	3	$\frac{1}{8}$	1 6 1 2 at $15\frac{1}{2}d.$ 4 0 3 3 3 7 <hr/> 2,0 2 0 4, 8 7 <hr/> £.102 8s. 7d. Ans.
2	$\frac{1}{8}$	1 2 1 0 at $14d.$ 2 0 1 8 <hr/> 2,0 1 4 1, 1 8 <hr/> £.70 11s. 8d. Ans.	3	$\frac{1}{8}$	1 2 1 0 at $15\frac{1}{2}d.$ 3 0 2 6 5 0 5 <hr/> 2,0 1 5 6, 2 11 <hr/> £.78 2s. 11d. Ans.

$$\begin{array}{r} 3 \frac{3}{4} \quad 1 \frac{1}{4} \quad 7 \ 6 \ 1 \ 2 \text{ at } 15\frac{1}{2}d. \\ 1 \ 9 \ 0 \ 3 \\ 4 \ 7 \ 5 \ 9 \end{array}$$

$$2,0 \quad 9 \ 9 \ 9,0 \ 9$$

£.499 10s. 9d. Ans.

$$4 \quad 1 \frac{1}{3} \quad 6 \ 1 \ 0 \ 0 \text{ at } 16d. \\ 2 \ 0 \ 3 \ 3 \ 4$$

$$2,0 \quad 8 \ 1 \ 3,3 \ 4$$

£.406 13s. 4d. Ans.

$$4 \quad 1 \frac{1}{3} \quad 7 \ 1 \ 2 \ 1 \text{ at } 16\frac{1}{2}d. \\ 1 \frac{1}{8} \quad 2 \ 3 \ 7 \ 3 \ 8 \\ 1 \ 4 \ 8 \ 4\frac{1}{2}$$

$$2,0 \quad 9 \ 6 \ 4,3 \ 0\frac{1}{2}$$

£.482 3s. 0 $\frac{1}{2}$ d. Ans.

$$4 \quad 1 \frac{1}{8} \quad 1 \ 2 \ 1 \ 8 \text{ at } 16\frac{1}{2}d. \\ 4 \ 0 \ 6 \\ 5 \ 0 \ 9$$

$$2,0 \quad 1 \ 6 \ 7,4 \ 9$$

£.83 14s. 9d. Ans.

$$4 \quad 1 \frac{1}{8} \quad 8 \ 1 \ 0 \ 0 \text{ at } 16\frac{1}{2}d. \\ 1 \frac{1}{4} \quad 2 \ 7 \ 0 \ 0 \\ 3 \ 3 \ 7 \ 6 \\ 1 \ 6 \ 8 \ 9$$

$$2,0 \quad 1 \ 1 \ 30,6 \ 3$$

£.565 6s. 3d. Ans.

$$4 \quad 1 \quad 1 \frac{1}{4} \quad 4 \ 1 \ 2 \ 8 \text{ at } 17d. \\ 1 \ 3 \ 7 \ 6 \\ 3 \ 4 \ 4$$

$$2,0 \quad 5 \ 8 \ 4,8$$

£.292 8s. Ans.

$$4 \quad 1 \frac{1}{4} \quad 1 \ 2 \ 3 \ 0 \text{ at } 17\frac{1}{2}d. \\ 1 \frac{1}{4} \quad 4 \ 1 \ 0 \\ 1 \frac{1}{4} \quad 1 \ 0 \ 2 \ 6 \\ 2 \ 5 \ 7\frac{1}{2}$$

$$2,0 \quad 1 \ 7 \ 6,8 \ 1$$

£.88 8s. 1 $\frac{1}{2}$ d. Ans.

$$4 \quad 1 \frac{1}{3} \quad 2 \ 3 \ 4 \ 0 \text{ at } 17\frac{1}{2}d. \\ 1 \frac{1}{3} \quad 7 \ 8 \ 0 \\ 2 \ 2 \ 2 \ 6$$

$$2,0 \quad 3 \ 4 \ 1,2 \ 6$$

£.170 12s. 6d. Ans.

$$4 \quad 1 \frac{1}{8} \quad 3 \ 4 \ 5 \ 0 \text{ at } 17\frac{1}{2}d. \\ 1 \frac{1}{8} \quad 1 \ 1 \ 5 \ 0 \\ 1 \frac{1}{8} \quad 4 \ 3 \ 1 \ 8 \\ 7 \ 1 \ 10\frac{1}{2}$$

$$2,0 \quad 5 \ 1 \ 0,3 \ 1\frac{1}{2}$$

£.255 3s. 1 $\frac{1}{2}$ d. Ans.

$$6 \quad 1 \frac{1}{2} \quad 4 \ 5 \ 6 \ 0 \text{ at } 18d. \\ 2 \ 2 \ 8 \ 0$$

$$2,0 \quad 6 \ 8 \ 4,0$$

£.342 Ans.

$$4 \quad 1 \frac{1}{8} \quad 5 \ 6 \ 7 \ 0 \text{ at } 18\frac{1}{2}d. \\ 2 \quad 1 \ 8 \ 9 \ 0 \\ 1 \frac{1}{8} \quad 9 \ 4 \ 5 \\ 1 \ 1 \ 8 \ 1\frac{1}{2}$$

$$2,0 \quad 8 \ 6 \ 2,3 \ 1\frac{1}{2}$$

£.431 3s. 1 $\frac{1}{2}$ d. Ans.

$$\begin{array}{r} 6 \frac{1}{2} \quad \frac{1}{2} \frac{1}{2} \frac{1}{2} \\ 6 \ 7 \ 8 \ 9 \text{ at } 18\frac{1}{2}d. \\ 3 \ 3 \ 9 \ 4 \ 6 \\ 2 \ 8 \ 2 \ 10\frac{1}{2} \end{array}$$

$$2,0 \quad 1 \ 0 \ 4 \ 6,6 \ 4\frac{1}{2}$$

$$\text{£.523 } 6s. \ 4\frac{1}{2}d. \text{ Ans.}$$

$$\begin{array}{r} 6 \frac{3}{4} \quad \frac{1}{2} \frac{1}{8} \\ 7 \ 8 \ 9 \ 0 \text{ at } 18\frac{3}{4}d. \\ 3 \ 9 \ 4 \ 5 \\ 4 \ 9 \ 3 \ 1\frac{1}{2} \end{array}$$

$$2,0 \quad 1 \ 2 \ 3 \ 2,8 \ 1\frac{1}{2}$$

$$\text{£.616 } 8s. \ 1\frac{1}{2}d. \text{ Ans.}$$

$$\begin{array}{r} 6 \ 1 \quad \frac{1}{2} \frac{2}{3} \frac{1}{6} \\ 8 \ 9 \ 0 \ 0 \text{ at } 19d. \\ 4 \ 4 \ 5 \ 0 \\ 7 \ 4 \ 1 \ 8 \end{array}$$

$$2,0 \quad 1 \ 4 \ 0 \ 9,1 \ 8$$

$$\text{£.704 } 11s. \ 8d. \text{ Ans.}$$

$$\begin{array}{r} 6 \ 1 \ \frac{1}{4} \quad \frac{1}{2} \frac{1}{8} \frac{1}{4} \\ 9 \ 0 \ 0 \ 0 \text{ at } 19\frac{1}{4}d. \\ 4 \ 5 \ 0 \ 0 \\ 7 \ 5 \ 0 \\ 1 \ 8 \ 7 \ 6 \end{array}$$

$$2,0 \quad 1 \ 4 \ 4 \ 3,7 \ 6$$

$$\text{£.721 } 17s. \ 6d. \text{ Ans.}$$

$$\begin{array}{r} 6 \ 1\frac{1}{2} \quad \frac{1}{2} \frac{1}{4} \\ 9 \ 8 \ 7 \ 6 \text{ at } 19\frac{1}{2}d. \\ 4 \ 9 \ 3 \ 8 \\ 1 \ 2 \ 3 \ 4 \ 6 \end{array}$$

$$2,0 \quad 1 \ 6 \ 0 \ 4,8 \ 6$$

$$\text{£.802 } 8s. \ 6d. \text{ Ans.}$$

$$\begin{array}{r} 6 \quad \frac{1}{2} \frac{1}{4} \frac{1}{8} \\ 8 \ 7 \ 6 \ 5 \text{ at } 19\frac{3}{4}d. \\ 4 \ 3 \ 8 \ 2 \ 6 \\ 1 \ 0 \ 9 \ 5 \ 7\frac{1}{2} \\ 1 \ 8 \ 2 \ 7\frac{1}{2} \end{array}$$

$$2,0 \quad 1 \ 4 \ 4 \ 2,5 \ 8\frac{1}{2}$$

$$\text{£.721 } 5s. \ 8\frac{1}{2}d. \text{ Ans.}$$

$$\begin{array}{r} 6 \quad \frac{1}{2} \frac{1}{4} \frac{1}{8} \\ 7 \ 1 \ 2 \ 0 \text{ at } 20\frac{1}{4}d. \\ 3 \ 5 \ 6 \ 0 \\ 1 \ 1 \ 8 \ 6 \ 8 \\ 1 \ 4 \ 8 \ 4 \end{array}$$

$$2,0 \quad 1 \ 2 \ 0 \ 1,5 \ 0$$

$$\text{£.600 } 15s. \ 0d. \text{ Ans.}$$

$$\begin{array}{r} 6 \quad \frac{1}{2} \frac{1}{4} \frac{1}{8} \\ 6 \ 5 \ 4 \ 3 \text{ at } 20\frac{1}{4}d. \\ 3 \ 2 \ 7 \ 1 \ 6 \\ 1 \ 0 \ 9 \ 0 \ 6 \\ 2 \ 7 \ 2 \ 7\frac{1}{2} \end{array}$$

$$2,0 \quad 1 \ 1 \ 1 \ 7,7 \ 7\frac{1}{2}$$

$$\text{£.558 } 17s. \ 7\frac{1}{2}d. \text{ Ans.}$$

$$\begin{array}{r} 6 \quad \frac{1}{2} \frac{1}{4} \frac{1}{8} \\ 5 \ 4 \ 3 \ 2 \text{ at } 20\frac{1}{4}d. \\ 2 \ 7 \ 1 \ 6 \\ 9 \ 0 \ 5 \ 4 \\ 2 \ 2 \ 6 \ 4 \\ 1 \ 1 \ 3 \ 2 \end{array}$$

$$2,0 \quad 9 \ 3 \ 9,2 \ 10$$

$$\text{£.469 } 12s. \ 10d. \text{ Ans.}$$

$$\begin{array}{r} 6 \ 3 \quad \frac{1}{2} \frac{1}{4} \frac{1}{8} \\ 4 \ 3 \ 2 \ 1 \text{ at } 21d. \\ 2 \ 1 \ 6 \ 0 \ 6 \\ 1 \ 0 \ 8 \ 0 \ 3 \end{array}$$

$$2,0 \quad 7 \ 5 \ 6,1 \ 9$$

$$\text{£.378 } 1s. \ 9d. \text{ Ans.}$$

$$\begin{array}{r} 6 \quad \frac{1}{2} \quad 3 \ 2 \ 1 \ 0 \text{ at } 21\frac{1}{2}d. \\ 3 \quad \frac{1}{2} \quad 1 \ 6 \ 0 \ 5 \\ \frac{1}{2} \quad \frac{1}{2} \quad 8 \ 0 \ 2 \ 6 \\ \quad \quad \quad 6 \ 6 \ 10\frac{1}{2} \end{array}$$

$$2,0 \quad 5 \ 6 \ 8,4 \quad 4\frac{1}{2}$$

$$\text{£.284 } 4s. \ 4\frac{1}{2}d. \text{ Ans.}$$

$$\begin{array}{r} 6 \quad \frac{1}{2} \quad 2 \ 1 \ 0 \ 0 \text{ at } 21\frac{1}{2}d. \\ 3 \quad \frac{1}{2} \quad 1 \ 0 \ 5 \ 0 \\ \frac{1}{2} \quad \frac{1}{2} \quad 5 \ 2 \ 5 \\ \quad \quad \quad 8 \ 7 \ 6 \end{array}$$

$$2,0 \quad 3 \ 7 \ 6,2 \ 6$$

$$\text{£.188 } 2s. \ 6d. \text{ Ans.}$$

$$\begin{array}{r} 6 \quad \frac{1}{2} \quad 1 \ 0 \ 0 \ 0 \text{ at } 21\frac{1}{2}d. \\ 3 \quad \frac{1}{2} \quad 5 \ 0 \ 0 \\ \frac{3}{4} \quad \frac{1}{4} \quad 2 \ 5 \ 0 \\ \quad \quad \quad 6 \ 2 \ 6 \end{array}$$

$$2,0 \quad 1 \ 8 \ 1,2 \ 6$$

$$\text{£.90 } 12s. \ 6d. \text{ Ans.}$$

$$\begin{array}{r} 6 \quad \frac{1}{2} \quad 1 \ 0 \ 9 \ 0 \text{ at } 22d. \\ 4 \quad \frac{1}{3} \quad 5 \ 4 \ 5 \\ \quad \quad \quad 3 \ 6 \ 3 \ 4 \end{array}$$

$$2,0 \quad 1 \ 9 \ 9,8 \ 4$$

$$\text{£.99 } 18s. \ 4d. \text{ Ans.}$$

$$\begin{array}{r} 6 \quad \frac{1}{2} \quad 9 \ 0 \ 1 \ 0 \text{ at } 22\frac{1}{4}d. \\ 3 \quad \frac{1}{2} \quad 4 \ 5 \ 0 \ 5 \\ 1 \quad \frac{1}{4} \quad 2 \ 2 \ 5 \ 2 \ 6 \\ \quad \quad \quad 7 \ 5 \ 0 \ 10 \\ \quad \quad \quad 1 \ 8 \ 7 \ 8\frac{1}{2} \end{array}$$

$$2,0 \quad 1 \ 6 \ 7 \ 0,6 \ 0\frac{1}{2}$$

$$\text{£.835 } 6s. \ 0\frac{1}{2}d. \text{ Ans.}$$

$$\begin{array}{r} 6 \quad \frac{1}{2} \quad 6 \ 7 \ 0 \ 0 \text{ at } 22\frac{1}{2}d. \\ 4 \quad \frac{1}{2} \quad 3 \ 3 \ 5 \ 0 \\ \frac{1}{2} \quad \frac{1}{2} \quad 2 \ 2 \ 3 \ 3 \ 4 \\ \quad \quad \quad 2 \ 7 \ 9 \ 2 \end{array}$$

$$2,0 \quad 1 \ 2 \ 5 \ 6,2 \ 6$$

$$\text{£.628 } 2s. \ 6d. \text{ Ans.}$$

$$\begin{array}{r} 6 \quad \frac{1}{2} \quad 6 \ 8 \ 1 \ 2 \text{ at } 22\frac{1}{2}d. \\ 4 \quad \frac{1}{2} \quad 3 \ 4 \ 0 \ 6 \\ \frac{1}{2} \quad \frac{1}{2} \quad 2 \ 2 \ 7 \ 0 \ 8 \\ \quad \quad \quad 2 \ 8 \ 3 \ 10 \\ \quad \quad \quad 1 \ 4 \ 1 \ 11 \end{array}$$

$$2,0 \quad 1 \ 2 \ 9 \ 1,4 \ 5$$

$$\text{£.645 } 14s. \ 5d. \text{ Ans.}$$

$$\begin{array}{r} 6 \quad \frac{1}{2} \quad 1 \ 2 \ 1 \ 0 \text{ at } 23d. \\ 4 \quad \frac{1}{2} \quad 6 \ 0 \ 5 \\ 1 \quad \frac{1}{4} \quad 4 \ 0 \ 3 \ 4 \\ \quad \quad \quad 1 \ 0 \ 0 \ 10 \end{array}$$

$$2,0 \quad 2 \ 3 \ 1,9 \ 2$$

$$\text{£.115 } 19s. \ 2d. \text{ Ans.}$$

$$\begin{array}{r} 6 \quad \frac{1}{2} \quad 1 \ 8 \ 0 \ 0 \text{ at } 23\frac{1}{4}d. \\ 4 \quad \frac{1}{2} \quad 9 \ 0 \ 0 \\ 1 \quad \frac{1}{4} \quad 6 \ 0 \ 0 \\ \quad \quad \quad 1 \ 5 \ 0 \\ \quad \quad \quad 3 \ 7 \ 6 \end{array}$$

$$2,0 \quad 3 \ 4 \ 8,7 \ 6$$

$$\text{174L } 7s. \ 6d. \text{ Ans.}$$

$$\begin{array}{r}
 6 \quad \frac{1}{2} \quad 6 \quad 7 \quad 6 \quad 0 \text{ at } 23\frac{1}{2}d. \\
 4 \quad \frac{1}{3} \quad 3 \quad 3 \quad 8 \quad 0 \\
 1\frac{1}{2} \quad \frac{1}{4} \quad 2 \quad 2 \quad 5 \quad 3 \quad 4 \\
 \quad \quad \quad 8 \quad 4 \quad 5 \quad 0 \\
 \hline
 2,0 \quad 1 \quad 3 \quad 2 \quad 3,8 \quad 4 \\
 \hline
 661\frac{1}{2} \text{ 18s. 4d. Ans.}
 \end{array}$$

$$\begin{array}{r}
 6 \quad \frac{1}{2} \quad 9 \quad 9 \quad 9 \quad 0 \text{ at } 23\frac{1}{2}d. \\
 4 \quad \frac{1}{3} \quad 4 \quad 9 \quad 9 \quad 5 \\
 1\frac{1}{2} \quad \frac{1}{4} \quad 3 \quad 3 \quad 3 \quad 0 \\
 \quad \quad \quad 1 \quad 2 \quad 4 \quad 8 \quad 9 \\
 \quad \quad \quad 2 \quad 0 \quad 8 \quad 1\frac{1}{2} \\
 \hline
 2,0 \quad 1 \quad 9 \quad 7 \quad 7,1 \quad 10\frac{1}{2} \\
 \hline
 988\frac{1}{2} \text{ 11s. 10}\frac{1}{2}d. \text{ Ans.}
 \end{array}$$

Case 4.

$$\begin{array}{r}
 486 \text{ at } 2s. \\
 1 \\
 \hline
 48\frac{1}{2} \text{ 12s. Ans.}
 \end{array}$$

$$\begin{array}{r}
 769 \text{ at } 4s \\
 2 \\
 \hline
 153\frac{1}{2} \text{ 16s. Ans.}
 \end{array}$$

$$\begin{array}{r}
 7612 \text{ at } 2s. \\
 1 \\
 \hline
 761\frac{1}{2} \text{ 4s. Ans.}
 \end{array}$$

$$\begin{array}{r}
 1286 \text{ at } 4s. \\
 2 \\
 \hline
 257\frac{1}{2} \text{ 4s. Ans.}
 \end{array}$$

$$\begin{array}{r}
 7618 \text{ at } 6s. \\
 3 \\
 \hline
 2285\frac{1}{2} \text{ 8s. Ans.}
 \end{array}$$

$$\begin{array}{r}
 121 \text{ at } 1s. \\
 1 \\
 \hline
 2,0)12,1 \\
 \hline
 6\frac{1}{2} \text{ 1s. Ans.}
 \end{array}$$

$$\begin{array}{r}
 191 \text{ at } 8s. \\
 4 \\
 \hline
 76\frac{1}{2} \text{ 8s. Ans.}
 \end{array}$$

$$\begin{array}{r}
 180 \text{ at } 10s. \\
 5 \\
 \hline
 90\frac{1}{2} \text{ 0s. Ans.}
 \end{array}$$

$$\begin{array}{r}
 171 \text{ at } 14s. \\
 7 \\
 \hline
 119\frac{1}{2} \text{ 14s. Ans.}
 \end{array}$$

$$\begin{array}{r}
 171 \text{ at } 16s. \\
 8 \\
 \hline
 136\frac{1}{2} \text{ 16s. Ans.}
 \end{array}$$

$$\begin{array}{r}
 712 \text{ at } 18s. \\
 9 \\
 \hline
 640\frac{1}{2} \text{ 16s. Ans.}
 \end{array}$$

Case 5.

$$\begin{array}{r}
 121 \text{ at } 3s. \\
 3 \\
 \hline
 2,0)36,3 \\
 \hline
 18\frac{1}{2} \text{ 3s. Ans.}
 \end{array}$$

471 at 5s.

5

2,0)235,5

117l. 15s. Ans.

860 at 7s.

7

2,0)602,0

301l. Ans.

612 at 9s.

9

2,0)550,8

275l. 8s. Ans.

121 at 11s.

11

2,0)133,1

66l. 11s. Ans.

600 at 13s.

13

2,0)780,0

390l. Ans.

190 at 15s.

15

2,0)285,0

142l. 10s. Ans.

121 at 17s.

17

2,0)205,7

102l. 17s. Ans.

100 at 19s.

19

2,0)190,0

95l. Ans.

## Case 6. 1st. part.

6s. 8d.  $\frac{1}{3}$  12 at 6s. 8d.

4l. Ans.

3 4  $\frac{1}{6}$  69 at 3s. 4d.

11l. 10s. Ans.

2s. 6d.  $\frac{1}{8}$  21 at 2s. 6d.

2l. 12s. 6d.

1 8  $\frac{1}{12}$  96 at 1s. 8d.

8l. Ans.

## Case 6. 2nd. part.

3  $\frac{1}{4}$  126 at 9s. 3d.

9

1134

31 6

2,0

116,5 6

58l. 5s. 6d. Ans.

6  $\frac{1}{2}$ 

4

 $\frac{1}{3}$ 

2,0

86 at 6s. 10d.

6

516

43

28 8

58,7 8

29l. 7s. 8d. Ans.



$$\begin{array}{r}
 4 \quad \frac{1}{3} \quad 10 \text{ at } 12s. 4d. \\
 \underline{12} \\
 120 \\
 3 \quad 4 \\
 \hline
 2,0 \quad 12,3 \quad 4 \\
 \hline
 6l. 3s. 4d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 6 \quad \frac{1}{2} \quad 30 \text{ at } 4s. 9d. \\
 \underline{4} \\
 120 \\
 15 \\
 7 \quad 6 \\
 \hline
 2,0 \quad 14,2 \quad 6 \\
 \hline
 7l. 2s. 6d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 6 \quad \frac{1}{2} \quad 73 \text{ at } 7s. 6d. \\
 \underline{7} \\
 511 \\
 36 \quad 6 \\
 \hline
 2,0 \quad 54,7 \quad 6 \\
 \hline
 27l. 7s. 6d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 4 \quad \frac{1}{3} \quad 70 \text{ at } 7s. 4\frac{1}{2}d. \\
 \underline{7} \\
 490 \\
 23 \quad 4 \\
 2 \quad 11 \\
 1 \quad 5\frac{1}{2} \\
 \hline
 2,0 \quad 51,7 \quad 8\frac{1}{2} \\
 \hline
 25l. 17s. 8\frac{1}{2}d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 6 \quad \frac{1}{2} \quad 55 \text{ at } 4s. 8\frac{1}{2}d. \\
 \underline{4} \\
 220 \\
 27 \quad 6 \\
 9 \quad 2 \\
 2 \quad 3\frac{1}{2} \\
 \hline
 2,0 \quad 25,8 \quad 11\frac{1}{2} \\
 \hline
 12l. 18s. 11\frac{1}{2}d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 6 \quad \frac{1}{2} \quad 77 \text{ at } 10s. 6\frac{1}{2}d. \\
 \underline{10} \\
 770 \\
 38 \quad 6 \\
 1 \quad 7\frac{1}{2} \\
 \hline
 2,0 \quad 81,0 \quad 1\frac{1}{2} \\
 \hline
 40l. 10s. 1\frac{1}{2}d. \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 6 \quad \frac{1}{2} \quad 12 \text{ at } 13s. 10\frac{1}{2}d. \\
 \underline{13} \\
 156 \\
 6 \\
 4 \\
 0 \quad 6 \\
 \hline
 2,0 \quad 16,6 \quad 6 \\
 \hline
 8l. 6s. 6d. \text{ Ans.}
 \end{array}$$

4	$\frac{1}{5}$	17 at 17s. $4\frac{1}{2}d.$	3	$\frac{1}{2}$	46 at 7s. $3\frac{1}{2}d.$
		17			7
		<hr/>			<hr/>
		289			322
$\frac{1}{4}$	$\frac{1}{18}$	5 8	$\frac{3}{4}$	$\frac{1}{2}$	11 6
		0 $4\frac{1}{2}$			2 $10\frac{1}{2}$
		<hr/>			<hr/>
		29,5 $0\frac{1}{4}$			33,6 $4\frac{1}{2}$
		<hr/>			<hr/>
		14l. 15s. $0\frac{1}{4}d.$ Ans.			16l. 16s. $4\frac{1}{2}$ Ans.

Case 7.

72 at 5l.

5

---

360l. Ans.

64 at 3l.

3

---

192l. Ans.

19 at 4l.

4

---

76l. Ans.

46 at 7l.

7

---

322l. Ans.

Case 8.

26 at 4l. 8s.

4

---

104

10 8

---

114l. 8s. Ans.

49 at 3l. 7s.

7

---

2,0)34,3

---

17 3

147

---

164l. 3s. Ans.

36 at 5l. 13s.

13

---

2,0)46,8

---

23 8

180

---

203l. 8s. Ans.

48 at 7l. 10s.

5

---

24 0

336

---

360l. 0s. Ans.

26 at 11 $\frac{1}{2}$ . 14s.

7

18 4

286

304 $\frac{1}{2}$ . 4s. Ans.15 at 4 $\frac{1}{2}$ . 13s.

13

2,0)19,5

9 15

60

69 $\frac{1}{2}$ . 15s. Ans.17 at 9 $\frac{1}{2}$ . 15s.

15

2,0)2,55

12 15

153

165 $\frac{1}{2}$ . 15s. Ans.16 at 3 $\frac{1}{2}$ . 6s.

3

4 16

48

52 $\frac{1}{2}$ . 16s. Ans.

## Case 9. 1st. part.

3s. 4d.  $\frac{1}{8}$ 47 at 3 $\frac{1}{2}$ . 3s. 4d.

3

141

7 16 8

148 $\frac{1}{2}$ . 16s. 8d. Ans.6s. 8d.  $\frac{1}{3}$ 17 at 2 $\frac{1}{2}$ . 6s. 8d.

2

34

5 13 4

39 $\frac{1}{2}$ . 13s. 4d. Ans.10 0  $\frac{1}{2}$ 20 at 4 $\frac{1}{2}$ . 13s. 4d.

4

80

10

3 6 8

93 $\frac{1}{2}$ . 6s. 8d. Ans.2 6  $\frac{1}{8}$ 30 at 1 $\frac{1}{2}$ . 2s. 6d.

3 15

33 $\frac{1}{2}$ . 15s. Ans.

## Case 9. 2nd. part.

3  $\frac{1}{4}$ 120 at 4 $\frac{1}{2}$ . 7s. 3 $\frac{1}{2}$ d.

87

20

10440

87

30

5

2,0)1047,5

523 $\frac{1}{2}$ . 15s. Ans.6  $\frac{1}{2}$ 14 at 2 $\frac{1}{2}$ . 10s. 6d.

50

20

700

50

7

2,0)70,7

35 $\frac{1}{2}$ . 7s. Ans.

6	$\frac{1}{2}$	21 at 3 <i>l</i> . 14 <i>s</i> . 7 $\frac{1}{2}$ <i>d</i> .	6	$\frac{1}{2}$	46 at 3 <i>l</i> . 19 <i>s</i> . 8 $\frac{1}{2}$ <i>d</i> .
		114 20			79 20
		<hr/>			<hr/>
		84 114			414 79
		231			322
		<hr/>			<hr/>
		2394			3634
1	$\frac{1}{8}$	10 6	2	$\frac{1}{8}$	23
$\frac{1}{4}$	$\frac{1}{4}$	1 9	$\frac{1}{2}$	$\frac{1}{4}$	7 8
		0 5 $\frac{1}{2}$			1 11
		<hr/>			<hr/>
2,0		240,6 8 $\frac{1}{2}$	2,0		366,6 7
		<hr/>			<hr/>
		120 <i>l</i> . 6 <i>s</i> . 8 $\frac{1}{2}$ <i>d</i> . Ans.			183 <i>l</i> . 6 <i>s</i> . 7 <i>d</i> . Ans.
		<hr/>			<hr/>
	$\frac{1}{2}$	70 at 1 <i>l</i> . 14 <i>s</i> . 7 <i>d</i> .			
		34 20			
		<hr/>			
		2380 34			
	$\frac{\pi}{6}$	35			
		5 10			
		<hr/>			
2,0		242,0 10			
		<hr/>			
		121 <i>l</i> . 0 <i>s</i> . 10 <i>d</i> . Ans.			

## Case 9. 3rd. part.

The following, by some, is considered a better method than that used by DILWORTH.

10 <i>s</i> . 0 <i>d</i> .	$\frac{1}{2}$	58361 at 48 <i>l</i> . 12 <i>s</i> . 9 <i>d</i> .	10 <i>s</i> . 0 <i>d</i> .	$\frac{1}{2}$	7000 at 17 <i>l</i> . 14 <i>s</i> . 8 <i>d</i> .
		48			17
		<hr/>			<hr/>
		466888			119000
		233444			3500
2	6 $\frac{1}{2}$	29180 10	4	0 $\frac{1}{2}$	1400
3	$\frac{1}{10}$	7295 2 6	8	$\frac{1}{10}$	233 6 8
		729 10 3			<hr/>
		<hr/>			124133 6 8 Ans.
		2838533 2 9 Ans.			

## Case 10.

C. gr. lb.	£.	s.	d.
12 3 16 at	4	12	0
2gr.Olb.	$\frac{1}{2}$		12
<hr/>			
	55	4	0
1 0	$\frac{1}{2}$	2	6 0
9 16	$\frac{1}{7}$	1	3 0
		0	13 $1\frac{1}{2}$
<hr/>			
Ans. £.59 6 $1\frac{1}{2}$			

C. gr. lb.	£.	s.	d.
12 2 14 at	3	14	0
2gr.Olb.	$\frac{1}{2}$		12
<hr/>			
	44	8	0
14	$\frac{1}{4}$	1	17 0
		9	3
<hr/>			
Ans. £ 46 14 3			

C. gr. lb.	£.	s.	d.
17 3 19 at	2	2	6
2gr.Olb.	$\frac{1}{2}$		17
<hr/>			
	36	2	6
1 0	$\frac{1}{2}$	1	1 3
16	$\frac{1}{7}$	10	$7\frac{1}{2}$
2	$\frac{1}{8}$	6	$0\frac{1}{2}$
1	$\frac{1}{2}$		9
			$4\frac{1}{2}$
<hr/>			
Ans. £.38 1 $6\frac{1}{2}$			

C. gr. lb.	£.	s.	d.
4 1 16 at	3	12	0
1gr.Olb.	$\frac{1}{4}$		4
<hr/>			
	14	8	0
16	$\frac{1}{7}$	18	0
		10	$3\frac{1}{2}$
<hr/>			
Ans. £.15 16 $3\frac{1}{2}$			

C. gr. lb.	£.	s.	d.
10 0 12 at	1	19	6
8lb.	$\frac{1}{1}$		10
<hr/>			
	19	15	0
4	$\frac{1}{2}$	2	$9\frac{1}{2}$
		1	$4\frac{1}{2}$
<hr/>			
Ans. £.19 19 $2\frac{1}{2}$			

C. gr. lb.	£.	s.	d.
5 1 0 at	2	17	0
1gr.	$\frac{1}{4}$		5
<hr/>			
	14	5	0
		14	3
<hr/>			
Ans. £ 14 19 3			

C. gr. lb.	£.	s.	d.
4 3 0 at	2	18	6
2gr.	$\frac{1}{2}$		4
<hr/>			
	11	14	0
1	$\frac{1}{2}$	1	9 3
		0	14 $7\frac{1}{2}$
<hr/>			
Ans. £.13 17 $10\frac{1}{2}$			

C. gr. lb.	£.	s.	d.
7 0 19 at	3	16	0
16lb.	$\frac{1}{7}$		7
<hr/>			
	26	12	0
2	$\frac{1}{8}$	0	10 $10\frac{1}{4}$
1	$\frac{1}{2}$	0	1 $4\frac{1}{4}$
		0	0 8
<hr/>			
Ans. £.27 4 $10\frac{1}{4}$			

C. gr. lb.		£. s. d.
5 2 10	at	2 18 6½
2gr.Olb.	½	5
<hr/>		
		14 12 8½
8	1/7	1 9 3½
2	1/4	4 2
		1 0½
<hr/>		
Ans. £. 16 7 2½		

C. gr. lb.		£. s. d.
7 1 14	at	3 15 9½
1gr.Olb.	¼	7
<hr/>		
		26 10 4½
14	1/2	18 11½
		9 5½
<hr/>		
Ans. £ 27 18 9½		

C. gr. lb.		£. s. d.
9 2 26	at	4 10 4½
2gr.Olb.	½	9
<hr/>		
		40 13 4½
16	1/7	2 5 2½
8	1/2	12 10½
2	1/4	6 5½
		1 7½
<hr/>		
Ans. £. 43 19 6		

C. gr. lb.		£. c.
18 1 18	at	10 25
1gr.Olb.	¼	18
<hr/>		
		184 50
16	1/7	2 56 2
2	1/8	1 46 4
		18 3
<hr/>		
Ans. £ 188 70 9		

T. C. gr. lb.		£. c.
7 17 3 20	at	25 50
10 0 00	½	7
<hr/>		
		178 50
5 0 00	1/4	12 75
2 0 00	1/8	6 37 5
2 00	1/4	2 55 0
1 00	1/2	63 7
16	1/4	31 8
4	1/2	18 2
		04 5
<hr/>		
Ans. £ 201 35 7		

C. gr. lb. oz.		£. c.
9 1 18 14	at	14 80
1 00 00	½	9
<hr/>		
		133 20
16 00	1/7	3 70
2 00	1/8	2 11 4
8	1/4	26 4
4	1/2	6 6
2	1/2	3 3
		1 6
<hr/>		
Ans. £ 139 39 3		

lb. oz. dr.		£. c.
5 7 14	at	1 25
4 0	¼	5
<hr/>		
		6 25
2 0	1/2	31 2
1 0	1/3	15 6
8	1/2	7 8
4	1/2	3 9
2	1/2	1 9
		9
<hr/>		
Ans. £ 6 86 3		

<i>lb. oz. dwt.</i>		<i>£ s. c.</i>
9 7 15	at	18 50
6 0	$\frac{1}{2}$	9
		<hr/>
		166 50
1 0	$\frac{1}{8}$	9 25
10	$\frac{1}{2}$	1 54 1
5	$\frac{1}{4}$	77 0
		<hr/>
		38 5
		<hr/>
Ans. £		178 44 6

<i>a. r. p.</i>		<i>£ s. c.</i>
96 1 19	at	64 50
1 00	$\frac{1}{4}$	96
		<hr/>
		387 00
		<hr/>
		5805 0
		<hr/>
		6192 00
10	$\frac{1}{4}$	16 12 5
8	$\frac{1}{8}$	4 03 1
1	$\frac{1}{8}$	3 22 5
		<hr/>
		40 3

Ans. £ 6215 78 4

<i>oz. dwt. gr.</i>		<i>£ s. c.</i>
17 17 19	at	1 18
10 00	$\frac{1}{4}$	17
		<hr/>
		20 06
5 00	$\frac{1}{2}$	59
2 00	$\frac{1}{8}$	29 5
16	$\frac{1}{4}$	11 8
2	$\frac{1}{8}$	3 9
1	$\frac{1}{4}$	5
		<hr/>
		2
		<hr/>
Ans. £		21 10 9

<i>C. gr. lb.</i>		<i>£ s. c.</i>
18 1 17 $\frac{1}{2}$	at	15 25
1 00	$\frac{1}{4}$	18
		<hr/>
		274 50
14	$\frac{1}{2}$	3 81 2
3 $\frac{1}{2}$	$\frac{1}{4}$	1 90 6
		<hr/>
		47 6
		<hr/>
Ans. £		280 69 4

<i>y. gr. n.</i>		<i>£ s. c.</i>
53 3	at	4 75
1 0	$\frac{1}{4}$	53
		<hr/>
		14 25
		<hr/>
		237 5
		<hr/>
		251 75
2	$\frac{1}{2}$	1 18 7
1	$\frac{1}{4}$	59 3
		<hr/>
		29 6
		<hr/>
Ans. £		253 82 6

		<i>£ s. c.</i>
50	$\frac{1}{2}$	1794 at 7 53
		<hr/>
		7
		<hr/>
		12558
2	$\frac{1}{2}$	897
1	$\frac{1}{2}$	35 88
		<hr/>
		17 94
		<hr/>
Ans. £		13508 82c.

OR THUS,	<i>£ s. c.</i>
1794 at 7 53	
753	
<hr/>	
5382	
8970	
12558	
<hr/>	

£ 13508 82c. Ans.

983 at 24c.

24

3932

1966

\$ 235 92c. Ans.

729½ at \$1 12c.

112

8748

729

56 =  $1\frac{1}{2}$ 

\$ 817 04c. Ans.

5627 at \$8 54c.

854

22508

28135

45016

\$ 48054 58c. Ans.

C. gr. lb.

58 2 22

2 00

L. s. d.

4 0 Q

58

14  $\frac{1}{2}$ 7  $\frac{1}{2}$ 1  $\frac{1}{7}$ 

232 0 0

2 0 0

10 0

5 0

0 8½

Ans. \$ 234 15 8½

T. C. gr. lb. oz. dr.

79 18 3 26 10 12

10 0 0 0 0

\$

at 60

79

4740

5 0 0 0 0  $\frac{1}{2}$  302 0 0 0 0  $\frac{1}{2}$  151 0 0 0 0  $\frac{1}{2}$  62 0 0 0 0  $\frac{1}{2}$  31 0 0 0 0  $\frac{1}{2}$  1 5016 0 0 0 0  $\frac{1}{2}$  758 0 0 0 0  $\frac{1}{2}$  42 82 0 0 0 0  $\frac{1}{2}$  21 48 0 0 0 0  $\frac{1}{2}$  5 32 0 0 0 0  $\frac{1}{2}$  1 38 0 0 0 0  $\frac{1}{2}$  34 0 0 0 0  $\frac{1}{2}$  1

0

Ans. \$ 4796 96 2



<i>T. C. gr. lb.</i>		<i>£</i>	<i>a. r. ft.</i>		<i>£. s. d.</i>
3 14 2 18	at	10 per C.	67 3 13	at	22 12 6 pr a.
20 2 00	$\frac{1}{4}$	74			6
74		740			135 15 0
16	$\frac{1}{4}$	5			11
2	$\frac{1}{8}$	1 42 8			1493 5 0
		17 8			2 00 $\frac{1}{2}$ 22 12 6

Ans. *£* 746 60 6

<i>lb. oz. dwt. gr.</i>		<i>l. s. d.</i>
7 5 15 14	at	5 2 6 pr lb.
4 00 00	$\frac{1}{3}$	7
		35 17 6
1 00 00	$\frac{1}{4}$	1 14 2
10 00	$\frac{1}{2}$	8 6 $\frac{1}{2}$
5 00	$\frac{1}{2}$	4 3 $\frac{1}{2}$
12	$\frac{1}{10}$	2 1 $\frac{1}{2}$
2	$\frac{1}{8}$	2 $\frac{1}{2}$
		0 $\frac{1}{2}$

Ans. *£* 38 6 10

<i>oz. dwt. gr.</i>		<i>£. s. d.</i>
14 17 17	at	0 7 8 pr oz.
10 00	$\frac{1}{2}$	14
		5 7 4
5 00	$\frac{1}{2}$	3 10
2 00	$\frac{1}{8}$	1 11
16	$\frac{1}{3}$	9 $\frac{1}{2}$
1	$\frac{1}{8}$	3
		0

Ans. *£* 5 14 1  $\frac{1}{2}$ 

<i>y. gr. n.</i>		<i>£. s. d.</i>
16 1 2	at	4 3 8 pr yd.
1 0	$\frac{1}{4}$	16
		66 8 8
2	$\frac{1}{2}$	1 0 1
		0 10 5 $\frac{1}{2}$

Ans. *£* 68 10 0  $\frac{1}{2}$ 

<i>a. r. ft.</i>		<i>£. s. d.</i>
67 3 13	at	22 12 6 pr a.
		6
		135 15 0
		11
		1493 5 0
2 00	$\frac{1}{2}$	22 12 6
1 00	$\frac{1}{2}$	11 6 3
10	$\frac{1}{4}$	5 13 1 $\frac{1}{2}$
2	$\frac{1}{8}$	1 8 3 $\frac{1}{2}$
1	$\frac{1}{2}$	5 7 $\frac{3}{4}$
		2 9 $\frac{1}{2}$

Ans. *£* 1534 13 7  $\frac{1}{2}$ 

<i>lb. oz. dr. sc. gr.</i>		<i>£ c.</i>
7 7 3 1 18	at	47 50 pr lb.
6 0 0 00	$\frac{1}{2}$	7
		332 50
1 0 0 00	$\frac{1}{6}$	23 75
2 0 00	$\frac{1}{4}$	3 95 8
1 0 00	$\frac{1}{2}$	98 9
1 00	$\frac{1}{3}$	49 4
10	$\frac{1}{2}$	16 5
4	$\frac{1}{5}$	8 2
4	$\frac{1}{8}$	3 3
		3 3

Ans. *£* 362 00 4

<i>y. gr. n.</i>		<i>£ c.</i>
83 0 3	at	5 50 per yd.
2	$\frac{1}{8}$	83
		16 50
		440 0
		456 50
1	$\frac{1}{2}$	68 7
		34 3

Ans. *£* 457 53 0

<i>E.E. gr. n.</i>		<i>£ c.</i>		<i>gal. qt. pt.</i>		<i>£ c.</i>
17 2 3	at	5 50	pr <i>E.E.</i>	15 3 1	at	1 25
2 2	$\frac{1}{2}$	17		2 0	$\frac{1}{2}$	15
		93 50				18 75
1	$\frac{1}{10}$	2 75		1 0	$\frac{1}{2}$	62 5
		27 5		1	$\frac{1}{2}$	31 2
						15 6

Ans. £ 96 52 5

Ans. £ 19 84 3

<i>E.F. gr. n.</i>		<i>£ c.</i>		<i>gal. qt. pt.</i>		<i>£. s. d.</i>
17 2 3	at	5 50	pr <i>E.F.</i>	87 1 1	at	0 7 8
1 2	$\frac{1}{2}$	17		1 0	$\frac{1}{4}$	12
		93 50				4 12 0
1 0	$\frac{1}{3}$	2 75				7
1	$\frac{1}{4}$	1 83 5				32 4 6
		45 8				1 3 0
				1	$\frac{1}{2}$	1 11
						11½

Ans. £ 98 54 1

Ans. £.33 9 10½

## SIMPLE INTEREST.

Case 1.

[1]	£.	[2]	£.	[3]	£.
486		220		76	
5		4		5	
24,30		8,80		380	
20		20		2	
6,00		16,00		7,60	
Ans. £ 24 6s.		Ans. £.8 16s.		20	
				12,00	
				Ans. £.7 12s.	

# INTEREST.

67

[4] £.  
400  
6

2400  
12

288,00

£.288 interest.  
400 principal.

[5] \$ c.  
128 50  
7

899 50  
3

Ans. \$26 98 5

[6] \$ c.  
845 96  
7

5921 72  
4

236 86 88  
845 96

Ans. \$ 1082 82 8

Ans. £. 688 amount.

## COMMISSION, &c.

[7] l. s. d.  
500 13 6  
3½

1502 0 6  
250 6 9

17,52 7 3  
20

10,47  
12

5,67  
4

2,68

Ans. £.17 10s. 5½d. +  $\frac{68}{100}$

[8] l. s.  
1009 18  
2½

2019 16  
252 9 6

22,72 5 6  
20

14,45  
12

5,46  
4

1,84

Ans. £.22 14s. 5½d. +  $\frac{84}{100}$

[9] l. s. d.  
1½ 1½ 704 15 4  
1½ 1½ 12

704 15 4  
1½ 1½ 352 7 8

176 3 10

12,33 6 10

20

6,66

12

8,02

Ans. £.12 6s. 8½d.

Case 2.

[1]

£.
200
5
—
$\frac{1}{2} \frac{1}{2}$ 1000
34
—
3000
$\frac{1}{4} \frac{1}{2}$ 500
250
—
37,50
20
—
10,00
Ans. £.37 10s.

[2]

£.	s.	d.
468	12	4
		6

$\frac{1}{2} \frac{1}{2}$	2811	14	0
$\frac{1}{2} \frac{1}{2}$	1405	17	0
$\frac{1}{2} \frac{1}{2}$	702	18	6
—	49,20	9	6
	20		
—	4,09		
	12		
—	1,14		

Ans. £.49 4 1 $\frac{1}{100}$ d.

[3]

£.	s.	d.
112	10	4
		6
—	675	2 0
		54
—	3375	10 0
	337	11 0
—	37,13	1 0
	20	
—	2,61	
	12	
—	7,32	
	4	
—	1,28	

Ans. £.37 2s. 7 $\frac{1}{2}$  +  $\frac{2}{100}$ d.

[4]

£ 468
6
—
2808
44
—
11232
702
—
119,34
20
—
6,80
12
—
9,60
4
—
2,40

Ans. £.119 6s. 9 $\frac{1}{2}$ d. +  $\frac{40}{100}$

[5] £.1000  
 4  
 4000  
 2½  
 8000  
 2000  
 1000  
 110,00  
 Ans. £.110

[6] \$ c.  
 74 68  
 7  
 522 76  
 3½  
 1568 28  
 261 38  
 Ans. \$ 18 29 6

[7] \$ c.  
 324 45  
 7  
 2271 15  
 5½  
 11355 75  
 1135 57  
 567 78  
 130 59 1 interest.  
 324 45 0 prin.  
 Ans. \$ 455 04 1 amount.

BROKAGE.

[8] s. £. s. d.  
 4 ½)700 14 6  
 1,40 2 10½  
 20  
 8,02  
 12  
 0,34  
 4  
 1,39  
 Ans. \$ .1 8s. 0½d.

[9] s. £. s. d.  
 5 ¼)500 10 7  
 2 ½)125 2 7½  
 50 1 0½  
 1,75 3 8½  
 20  
 15,03  
 12  
 0,44  
 4  
 1,77  
 Ans. 17. 15s. 0½d.

[10] s. d. £. s. d.  
 5 0 ¼)909 14 10  
 1 0 ½)227 8 8½  
 6 ½)45 9 8½  
 22 14 10½  
 2,95 13 3½  
 20  
 19,13  
 12  
 1,59  
 4  
 2,38  
 Ans. £. 2 19s. 1½d.

$$\begin{array}{r}
 [11] \quad \text{\$} \quad \text{c.} \\
 659 \quad 80 \\
 \quad \quad 73 \\
 \hline
 197940 \\
 461860 \\
 \hline
 4,81,6540 \\
 \text{Ans. \$} 4 \quad 81 \quad 6
 \end{array}$$

$$\begin{array}{r}
 [12] \quad \text{\$} \quad \text{c.} \\
 537 \quad 28 \\
 \quad \quad 91 \\
 \hline
 53728 \\
 483552 \\
 \hline
 4,88,9248 \\
 \text{Ans. \$} 4 \quad 88 \quad 9
 \end{array}$$

Case 3.

$$\begin{array}{r}
 [1] \quad 400\% \\
 \quad \quad 5\frac{1}{2} \\
 \hline
 2000 \\
 200 \\
 \hline
 2200 \\
 2 \\
 \hline
 44,00 \\
 \text{Ans. } 44\% \\
 \hline
 [2] \quad 120\% \\
 \quad \quad 4\frac{1}{2} \\
 \hline
 480 \\
 60 \\
 \hline
 5,40 \\
 20 \\
 \hline
 8,00 \\
 \text{Ans. } 5\% \quad 8\%
 \end{array}$$

$$\begin{array}{r}
 [3] \quad 690\% \\
 \quad \quad 4\frac{1}{2} \\
 \hline
 2760 \\
 172 \quad 10 \\
 \hline
 2932 \quad 10 \\
 3 \\
 \hline
 87,97 \quad 10 \\
 20 \\
 \hline
 19,50 \\
 12 \\
 \hline
 6,00 \\
 \text{\$} \quad \text{s.} \quad \text{d.} \\
 87 \quad 19 \quad 6 \\
 690 \\
 \hline
 777 \quad 19 \quad 6 \quad \text{Ans.}
 \end{array}$$

# INTEREST.

71

[4]

<i>l.</i>	<i>s.</i>	
120	10	
		4½
<hr/>		
482	0	
60	5	
30	2	6
<hr/>		
572	7	6
		2½

1144	15	0
286	3	9

14,30	18	9
20		

6,18
12

2,25
4

1,00

<i>l.</i>	<i>s.</i>	<i>d.</i>
120	10	0
14	6	2½

134 16 2½ Ans.

[6]

<i>£</i>	<i>s.</i>
75	50
	4½

302	06
18	87 5

320	87 5
	3½

962	62 5
160	43 7

Ans. £ 11 23 0

[5]

300%  
3½

900
150
75

1125
5½

5625
562 10
281 5

64,68	15
20	

13,75
12

9,00

Ans. 64. 13s 9d.

[7]

<i>£</i>	<i>s.</i>
82	29
	6½

493	74
41	14 5

534	88 5
	11½

5883	73 5
267	44 2
133	72 1

62	84 8
82	29

Ans. £ 145 13 8

### Case 4.

The following rule is preferred by some. Multiply the principal by the rate, and this product by the number of weeks: the last product divided by 5200 gives the interest.

[1] 400l.  
5  
—  
2000  
1  
—  
2000  
20  
— s. d.  
52,00)400,00(7 8 $\frac{1}{2}$  +  $\frac{1}{2}$  Ans.  
364  
—  
36  
12  
—  
432  
416  
—  
16  
4  
—  
64  
52  
—  
12



[3] 500%.  
3½

1500

250

1750

20

*l. s. d.*

52,00)350,00( 6 14 7½ + 28  
312 500

38

20

506 14 7½ + 28  
32

Ans.

760

52

240

208

32

12

384

364

20

4

80

52

28

[4] \$ c.  
74 86  
7

524 02

18

— \$ c.

5200)9432 36(1 81 20 38 An.  
5200

42323

41600

7236

5200

2036

[5] \$ c.  
324 69  
7

2272 83

45

1136415

909132

— \$ c.

5200)10227735(19 66 48 35  
5200 324 69

50277 \$344 35 48 35  
51800

46800 Ans.

34773

31200

35735

31200

4535

## Case 5.

$$\begin{array}{r}
 \text{£.5} \quad [1] \\
 4 \\
 \hline
 45 \\
 100 \\
 \hline
 \text{£.} \quad \text{£.} \\
 145 : 100 :: 725 \\
 \qquad 100 \\
 \qquad \text{£.} \\
 145)72500(500 \text{ An.} \\
 \quad 725 \\
 \quad \hline
 \quad \quad 00
 \end{array}$$

$$\begin{array}{r}
 \text{£.4} \quad [2] \\
 7 \\
 \hline
 28 \\
 100 \\
 \hline
 \text{£.} \quad \text{£.} \quad \text{s.} \\
 128 : 100 :: 793 \text{ } 12 \\
 \qquad 20 \\
 \qquad \hline
 \qquad 15872 \\
 \qquad \quad 100 \\
 \qquad \quad \hline
 \qquad \quad 20 \\
 128)1587200(1240,0 \\
 \quad 128 \\
 \quad \hline
 \quad \quad \text{£.620} \\
 \quad \quad \text{Ans.} \\
 \quad \quad 307 \\
 \quad \quad 256 \\
 \quad \quad \hline
 \quad \quad \quad 512 \\
 \quad \quad \quad 512 \\
 \quad \quad \quad \hline
 \quad \quad \quad \quad 00
 \end{array}$$

$$\begin{array}{r}
 \text{£.3} \quad [3] \\
 8 \\
 \hline
 24 \\
 100 \\
 \hline
 \text{£.} \quad \text{£.} \quad \text{s.} \\
 124 : 100 :: 520 \text{ } 16 \\
 \qquad 20 \\
 \qquad \hline
 \qquad 10416 \\
 \qquad \quad 100 \\
 \qquad \quad \hline
 \qquad \quad 20 \\
 124)1041600(840,0 \\
 \quad 992 \\
 \quad \hline
 \quad \quad \text{£.420} \\
 \quad \quad 496 \\
 \quad \quad 496 \\
 \quad \quad \hline
 \quad \quad \quad 00
 \end{array}$$

$$\begin{array}{r}
 \text{£7} \quad [4] \\
 5 \\
 \hline
 35 \\
 100 \\
 \hline
 \text{£} \quad \text{£} \\
 135 : 100 :: 426 \\
 \qquad 100 \\
 \qquad \hline
 \qquad \text{£} \quad \text{s.} \\
 135)42600(315 \text{ } 55 \text{ } 75 \\
 \quad 405 \\
 \quad \hline
 \quad \quad 210 \\
 \quad \quad 135 \\
 \quad \quad \hline
 \quad \quad \quad 750 \\
 \quad \quad \quad 675 \\
 \quad \quad \quad \hline
 \quad \quad \quad 750 \\
 \quad \quad \quad 675 \\
 \quad \quad \quad \hline
 \quad \quad \quad \quad 750 \\
 \quad \quad \quad \quad 675 \\
 \quad \quad \quad \quad \hline
 \quad \quad \quad \quad \quad 75
 \end{array}$$

$$\begin{array}{r}
 \$7 \\
 8 \\
 \hline
 56 \\
 100 \\
 \hline
 \end{array}
 \quad [5]$$

$$\begin{array}{r}
 \$ \\
 156 : 100 :: 94 \text{ } 83 \\
 \hline
 100 \\
 \hline
 \$ \text{ } c. \\
 156)948300(60 \text{ } 78 \frac{132}{188} \\
 \underline{936} \\
 1230 \\
 \underline{1092} \\
 1380 \\
 \underline{1248} \\
 132
 \end{array}$$

Case 6.

$$\begin{array}{r}
 £.725 \quad [1] \\
 500 \\
 \hline
 £. \quad \hline
 500 : 225 :: 100 \\
 \hline
 100 \\
 5,00)225,90 \\
 \underline{9)45} \\
 \text{Ans. 5 per cent.}
 \end{array}$$

$$\begin{array}{r}
 [2] \quad \begin{array}{r} £. \text{ } s. \\ 793 \text{ } 12 \\ 620 \text{ } 00 \end{array} \\
 \hline
 \begin{array}{r} £. \quad \hline \\ £. \end{array} \\
 620 : 173 \text{ } 12 :: 100 \\
 \hline
 20 \quad 20 \\
 \hline
 12400 \quad 3472 \\
 \hline
 100 \\
 \hline
 7 \\
 124,00)3472,00(28 \\
 \underline{248} \\
 \hline
 \text{Ans. 4 per cent.} \\
 992 \\
 992
 \end{array}$$

$$\begin{array}{r}
 [3] \quad \begin{array}{r} £. \text{ } s. \\ 520 \text{ } 16 \\ 420 \text{ } 00 \end{array} \\
 \hline
 £. \quad \hline
 420 : 100 \text{ } 16 :: 100 \\
 \hline
 20 \quad 20 \\
 \hline
 8400 \text{ } 2016 \\
 \hline
 100 \\
 \hline
 8 \\
 84,00)2016,00(24 \\
 \underline{168} \\
 \hline
 \text{An. 3 per cent.} \\
 336 \\
 336
 \end{array}$$

[4]  $\begin{array}{r} \$ \\ 958 \text{ } 60 \\ 720 \\ \hline \$ \\ 720 : 238 \text{ } 60 :: 100 \\ \hline 100 \\ \hline \text{ } 5 \text{ } c. \\ \hline 720)2386000(33 \text{ } 13 \\ 2160 \\ \hline \text{ } \text{An. } 6 \text{ } 62 + \text{ per} \\ 2260 \text{ } \text{cent.} \\ 2160 \\ \hline \\ 1000 \\ 720 \\ \hline 2800 \\ 2160 \\ \hline 640 \end{array}$

[5]  $\begin{array}{r} £.528 \\ 359 \\ \hline £. \text{ } \text{ } £. \\ 359 : 169 :: 100 \\ \hline 100 \\ \hline \text{ } 8 \text{ } s. \text{ } d. \\ \hline 359)16900(47 \text{ } 1 \text{ } 6 \\ 1436 \\ \hline \text{ } \text{A. } 5 \text{ } 17 \text{ } 8 \frac{1}{2} + \text{ per} \\ 2540 \text{ } \text{cent.} \\ 2513 \\ \hline 27 \\ 20 \\ \hline 540 \\ 359 \\ \hline 181 \\ 12 \\ \hline 2172 \\ 2154 \\ \hline 18 \end{array}$

## Case 7.

$\begin{array}{r} £.500 \\ 5 \\ \hline 25,00 \end{array}$  [1]  $\begin{array}{r} 725 \\ 500 \\ \hline £. \text{ } y. \text{ } \text{ } \\ 25 : 1 :: 225 \\ 1 \\ \hline \text{ } \text{yrs.} \\ 25)225(9 \text{ An.} \\ 225 \\ \hline \end{array}$

[3]  $\begin{array}{r} £.420 \\ 3 \\ \hline 12,60 \\ 20 \\ \hline 12,00 \\ l. \text{ } s. \text{ } yr. \\ 12 \text{ } 12 : 1 :: 100 \text{ } 16 \\ 20 \\ \hline \text{ } \text{yr.} \\ 252)2016(8 \text{ Ans.} \\ 2016 \\ \hline \end{array}$

[2]  $\begin{array}{r} £. \\ 620 \\ 4 \\ \hline 24,16 : 1 :: 173 \text{ } 12 \\ 24,80 \text{ } 20 \\ 20 \text{ } \text{ } \\ \hline 496 \\ 16,00 \end{array}$   $\begin{array}{r} £. \text{ } s. \\ 793 \text{ } 12 \\ 620 \text{ } 00 \\ \hline \text{ } \text{ } \text{ } \\ 496)3472(7 \text{ yrs. Ans.} \\ 3472 \\ \hline \end{array}$

# INTEREST.

77

6.750 [4]  
 7  
 52,50  
 20

990  
 10,00 750  
 l. s. yr. —  
 52 10 : 1 :: 240  
 20 20

1050 105,0)480,0(4 208  $\frac{60}{105}$   
 420 Ans.

60  
 365  
 21900  
 210

900  
 840  
 60  
 383

8. 8. [5]  
 328 645  
 7 328  
 yr.  
 22.96 : 1 :: 317

100  
 y. da.  
 2296)31700(13 294  $\frac{956}{2296}$   
 2296 Ans.

8740  
 6888  
 1852  
 365

9260  
 11112  
 5556

2296)675980(294  
 4592  
 21678  
 20664

10140  
 9184  
 956

## SIMPLE INTEREST FOR DAYS.

[1]	£. 120		[2]	£. 126	
	4			6	
	<hr/>			<hr/>	
	480			756	
	126			145	
	<hr/>			<hr/>	
	2880			3780	
	5760			10584	
	<hr/>			<hr/>	
	£. s. d.			£. s. d.	
36500)60480(1	13 1½ + 258		36500)109620(3	0 0½ + 57	
36500	Ans.		109560		
<hr/>			<hr/>		
23980			120		
20			20		
<hr/>			<hr/>		
479600			2400		
36500			12		
<hr/>			<hr/>		
114600			28800		
109500			4		
<hr/>			<hr/>		
5100			115200		
12			109560		
<hr/>			<hr/>		
61200			57 00		
36500			365700		
<hr/>			<hr/>		
24700					
4					
<hr/>					
98800					
73000					
<hr/>					
258 00					
365700					

[3\*]

June	-	30	£. 100
July	-	31	5
Aug.	-	31	—
Sept.	-	30	500
Oct.	-	31	283
Nov.	-	30	—
Dec.	-	31	— £. s. d.
Jan.	-	31	365,00)1415,00(3 17 6½ + 23½ An.
Feb.	-	29	1095
Mar.	-	9	—
			320
			20
			—
			6400
			365
			—
			2750
			2555
			—
			195
			12
			—
			2340
			2190
			—
			150
			4
			—
			600
			365
			—
			23½
			383

\* In questions of this nature Dilworth counts the days on which the money was lent and paid.

[4]

Aug. - 18  
 Sep. - 30  
 Oct. - 31  
 Nov. - 30  
 Dec. - 19

---

 128

£. 200

6

---

 1200

128

---

 £. s. d.

 365)1536,00(4 4 1 $\frac{1}{2}$  +  $\frac{325}{365}$  Ans.

---

 1460

76

20

---

 1520

1460

---

 60

12

---

 720

365

---

 355

4

---

 1420

1095

---

 325

[5]

£. 10

5

---

 50

25

---

 1250

20

---

 25000

12

---

 - d.

 365,00)3000,00(8  $\frac{80}{365}$  Ans.

2920

---

 80

[6]

£. 40

4

---

 160

40

---

 6400

20

---

 - s. d.

 365,00)1280,00(3 6  $\frac{30}{365}$  Ans.

1095

---

 185

12

---

 2220

2190

---

 30



[7]      \$ 84  
           7  


---

           588  
           63  


---

           1764  
          3528  


---

               \$ c.  
36500)37044(1 01  $\frac{179}{365}$  Ans.  
          36500  


---

           54400  
          36500  


---

           179 00  
          365000

[8]      \$ c.  
          247 39  
               7  


---

          1731 73  
              1 38  


---

          1385384  
          519519  
          173173  


---

               \$ c.  
36500)23897874(6 54  
          219000  


---

          199787  
          182500  


---

          172874  
          146000  


---

               26874  
              36500  
               \$ c.  
           247 39  
               6 54  $\frac{26874}{36500}$   
               36500  
               \$ 253 93  $\frac{26874}{36500}$  Ans.

## COMPOUND INTEREST.

NOTE. When the rate per cent is an aliquot part of 100, and indeed in almost all other cases, the operation will be shorter by taking parts of 100.

£.      [1]  
 $5 = \frac{1}{20}$  450  
          22 10  


---

 $5 = \frac{1}{20}$  472 10      Amt. for  
          23 12 6      1st year.  


---

 $5 = \frac{1}{20}$  496 2 6      Amt. for  
          24 16 1½      2d year.  


---

           Ans. 520 18 7½      Amt. for  
                                   3rd year.

£.      [2]  
 $5 = \frac{1}{20}$  400  
 $1 = \frac{1}{5}$  20  
           4  


---

 $5 = \frac{1}{20}$  424      Amt. for 1st yr.  
 $1 = \frac{1}{5}$  21 4  
           4 4 9½  


---

 $5 = \frac{1}{20}$  449 8 9½      2d yr.  
 $1 = \frac{1}{5}$  22 9 5½  
           4 9 10½  


---

 $5 = \frac{1}{20}$  476 8 1½      3d yr.  
 $1 = \frac{1}{5}$  23 16 4½  
           4 15 3½  


---

           Ans. 504 19 9¼      4th yr.

[3]			[5]		
£.			l. s.		
$5 = \frac{1}{20}$	480		$2 = \frac{1}{20}$	400	10
	24		$1 = \frac{1}{20}$	8	0 2½
			$\frac{1}{2} = \frac{1}{20}$	4	0 1
				2	0 0½
$5 = \frac{1}{20}$	504	Amt. for 1st yr.			
	25	4			
$5 = \frac{1}{20}$	529	4	$2 = \frac{1}{20}$	414	10 3½
	26	9 2½	$1 = \frac{1}{20}$	8	5 9½
			$\frac{1}{2} = \frac{1}{20}$	4	2 10½
				2	1 5½
$5 = \frac{1}{20}$	555	13 2½			
	27	15 7½	$2 = \frac{1}{20}$	429	0 5½
			$1 = \frac{1}{20}$	8	11 7½
			$\frac{1}{2} = \frac{1}{20}$	4	5 9½
$5 = \frac{1}{20}$	583	8 10		2	2 10½
	29	3 5½			
$5 = \frac{1}{20}$	612	12 3½		444	00 9
	30	12 7½		400	10 0
Ans.	643	4 10½	Ans.	£. 43	10 9

[4]			[6]		
£.			s. c. m.		
$4 = \frac{1}{25}$	500		$5 = \frac{1}{20}$	78	43 0
$\frac{1}{4} = \frac{1}{100}$	20		$2 = \frac{1}{50}$	3	92 1
	1	5		1	56 8
$4 = \frac{1}{25}$	521	5 Amt for 1st yr.	$5 = \frac{1}{20}$	83	91 9
$\frac{1}{4} = \frac{1}{100}$	20	17	$2 = \frac{1}{50}$	4	19 5
	1	6 0½		1	67 8
$4 = \frac{1}{25}$	543	8 0½	$5 = \frac{1}{20}$	89	79 2
$\frac{1}{4} = \frac{1}{100}$	21	14 8½	$2 = \frac{1}{50}$	4	48 9
	1	7 2		1	79 6
$4 = \frac{1}{25}$	566	9 11½	$5 = \frac{1}{20}$	96	07 7
$\frac{1}{4} = \frac{1}{100}$	22	13 2½	$5 = \frac{1}{20}$	4	80 3
	1	8 4		1	92 1
Ans.	590	11 5½	$5 = \frac{1}{20}$	102	80 1
			$2 = \frac{1}{50}$	5	14 0
				2	05 6
			Ans.	£ 109	99 7

OF REBATE OR DISCOUNT.

[1]      m.    £.    m.  
12 : 6 :: 11

11  
—  
12)66

£. s.  
5-10  
100

5 10

£. s.      £. s. d.  
105 10 : 5 10 :: 795 11 2  
20      20      11

£. s. d.  
211,0    11,0 211)8751 2 10(41 9 5½ + 1½  
844      Ans.

311  
211

100  
20

2002  
1899

103  
12

1246  
1055

191  
4

764  
633

131

## REBATE OR DISCOUNT.

$$[2] \quad m. \quad s. \quad m. \\ 12 : 5 :: 19$$

$$\begin{array}{r} 5 \\ \hline 12 \end{array} 95$$

$$\begin{array}{r} f. \quad s. \quad d. \\ 7 \quad 18 \quad 4 \end{array} \quad \begin{array}{r} 7 \quad 18 \quad 4 \end{array}$$

100

$$\begin{array}{r} f. \quad s. \\ 107 \quad 18 \quad 4 : 100 :: 161 \quad 10 \end{array}$$

$$\begin{array}{r} 20 \end{array} \quad \begin{array}{r} 20 \end{array}$$

$$\begin{array}{r} 2158 \end{array} \quad \begin{array}{r} 3230 \end{array}$$

$$\begin{array}{r} 12 \end{array} \quad \begin{array}{r} 12 \end{array}$$

$$\begin{array}{r} 25900 \end{array} \quad \begin{array}{r} 38760 \end{array}$$

$$\begin{array}{r} 100 \end{array}$$

$$\begin{array}{r} f. \quad s. \quad d. \\ 259,00 \end{array} \begin{array}{r} 38760,00 \end{array} \begin{array}{r} 149 \quad 13 \quad 0 \frac{1}{2} + \frac{106}{100} \end{array}$$

$$\begin{array}{r} 259 \end{array}$$

Ans.

$$\begin{array}{r} 1286 \end{array}$$

$$\begin{array}{r} 1036 \end{array}$$

$$\begin{array}{r} 2500 \end{array}$$

$$\begin{array}{r} 2331 \end{array}$$

$$\begin{array}{r} 169 \end{array}$$

$$\begin{array}{r} 20 \end{array}$$

$$\begin{array}{r} 3380 \end{array}$$

$$\begin{array}{r} 259 \end{array}$$

$$\begin{array}{r} 790 \end{array}$$

$$\begin{array}{r} 777 \end{array}$$

$$\begin{array}{r} 13 \end{array}$$

$$\begin{array}{r} 12 \end{array}$$

$$\begin{array}{r} 156 \end{array}$$

$$\begin{array}{r} 4 \end{array}$$

$$\begin{array}{r} 624 \end{array}$$

$$\begin{array}{r} 518 \end{array}$$

$$\begin{array}{r} 106 \end{array}$$

# REBATE OR DISCOUNT.

35

[3]      *m.   £.   s.   m.*  
 12 : 3 10 :: 4

4  
 12)14 00

*£.   s.   d.*      1   3   4  
 1   3   4

100

*£.   s.   d.*  
 101   3   4 : 100 :: 795   11   3  
 20      20

2023      15911  
 12      12

24280      190934  
 100

*£.   s.   d.*  
 2428,0)1909340,0(786   7   8 <sup>304</sup>/<sub>2428</sub> Ans.  
 16996

20974  
 19424

15500  
 14568

932  
 20

18640  
 16996

1644  
 12

19728  
 19424

<sup>304</sup>/<sub>2428</sub>

**REBATE OR DISCOUNT.**

[4]            m.    £. s.    m.  
                 12 : 4 15 :: 9

**12 : 4 15 :: 9**

9

12)42 15

**£. s. d.**

**3 11 3**

100

**3 11 3**

$$\frac{103\ 11\ 3}{100} :: \frac{4000}{100}$$

20

20

2071

2000

12

12

**24855**

**24000**

**4000**

**f. s. d.**

$$24855)96000000(3862 \text{ R } 804 + \text{Ans.}$$

**74565**

**214350**

**198840**

155100

**149130**

**59700**

**49710**

9990

20

**199800**

**198840**

960

12

11520

4

46080

**24855**

~~21225~~

**24883**

# REBATE OR DISCOUNT.

87

[5]    *m.*   *£.*   *m.*  
          12 : 5 :: 15  
                      5  
                      —  
              12)75  
                      —

[6]    *m.*   *£.*   *m.*  
          12 : 5 :: 3  
                      5  
                      —  
              12)15  
                      —

*£. s.*  
    6 5  
 100  
 ———  
 106 5 : 100 :: 18  
    20       20  
 ———  
 2125       2000  
              18

*£. s.*  
    1 5  
 100  
 ———  
 101 5 : 100 :: 810  
    20       20  
 ———  
 2025       2000  
              810

*£. s. d.*  
 2125)36000(16 18 9½+  
      2125               Ans.

*£.*  
 2025)1620000(800 Ans.  
      16200

14750  
 12750  
 ———

—  
 00

2000  
    20  
 ———

40000  
 2125  
 ———

18750  
 17000  
 ———

1750  
    12  
 ———

21000  
 19125  
 ———

1875  
    4  
 ———

7500  
 6375  
 ———

1125  
 1125

		[7]		Da.	£.	Da.
July	8			365	: 6 ::	155
Aug.	31					6
Sept.	30					— £. s. d.
Oct.	31			365	930(2	10 11½
Nov.	30				730	
Dec.	25				—	
					200	
		155	•		20	
					—	
£. s. d.						
2	10	11½			4000	
100					3650	
					—	
102	10	11½	:	£.	£.	
20				100	::	1000
				20		12
					—	
2050				2000		4200
12				12		4015
					—	
24611				24000		185
4				4		4
					—	
98446				96000		740
				1000		730
					—	
				£. s. d.		
98446	96000000	(975	3 0½ +	Ans.	10	
	886014					
	739860					
	689122					
	507380					
	492230					
	15150					
	20					
	303000					
	295338					
	7662					
	12					
	91944					
	4					
	367776					
	295338					
	72438					



# REBATE OR DISCOUNT.

89

Aug. 3	[8]	D.	£.	D.
Sept. 30		365	: 8 ::	301
Oct. 31				8
Nov. 30				£. s. d.
Dec. 31		365	2408(6 11 11	
Jan. 31			2190	
Feb. 29				
Mar. 31			218	
April 30	£. s. d.			20
May 31	6 11 11			
June 24	100			4360
		£.	£.	4015
301	106 11 11 : 100 ::	326		
	20	20		345
				12
	2131	6520		
	12	12		4140
				4015
	25583	78240		
		100		125

25583)7824000(305 16 6½ Ans.  
76749

149100  
127915  
21185  
20  
423700  
25583  
167870  
153498  
14372  
12  
172464  
153498  
18966  
4  
75864  
51166  
24698

[9]

*m. £. m.*  
 12 : 5 :: 3  
           5

*m. £. m.*  
 12 : 5 :: 6  
           5

12)15  
 ———

12)30  
 ———

1 5

*£. s.*  
 2 10

2 10

*£. s.*  
 1 5

100

100

———— *£. s. £.*  
 101 5 : 1 5 :: 156  
       20   20   25

———— *£. s. £.*  
 102 10 : 2 10 :: 156  
       20   20   50

————  
 2025   25   780

———— *£. s. d.*  
 2050   50 205,0)780,0(3 16 1

312

615

———— *£. s. d.*  
 2025)3900(1 18 6

165

2025

20

1875

3300

20

205

37500

1250

2025

1230

17250

20

16200

12

1050

240

12

205

12600

25

12150

450

*l. s. d.*

1 18 6

3 16 1

5 14 7 Ans.

[10] *m. l. m.*

12 : 4 :: 2

4

12)8

*l. s. d.*

0 13 4

100

*s. d. l.*

100 13 4 : 13 4 :: 100

20

12

2013

160

12

100

24160

16000

20

2416,0)32000,0(13 2½

2416

7840

7248

592

12

7104

4832

2272

4

9088

7248

1840

*l. s. d. :*

0 13 2½

1 6 3½

1 19 2½

3 18 9 Ans.

*m. l. m.*

12 : 4 :: 4

4

12)16

*£. s. d.*

1 6 8

100

1 6 8

*£. s. d. £.*

101 6 8 : 1 6 8 :: 100

20

20

2026

26

12

12

24320

320

100

2432,0)3200,0(1 6 3½

2432

768

20

15360

14592

768

12

9216

7296

1920

4

7680

7296

384

*m. l. m.*

12 : 4 :: 6

4

12)24

2

100

2

102 : 2 :: 100

2

102)200(1 19 2½

102

98

20

1960

102

940

918

22

12

264

204

60

4

240

204

36

$$[11] \quad m. \quad f. \quad m. \\ 12 : 5 :: 4 \\ \quad \quad \quad 5$$

$$m. \quad f. \quad m. \\ 12 : 5 :: 8 \\ \quad \quad \quad 5$$

---

12)20

---

12)40
*l. s. d.*

1 13 4

1 13 4

*l. s. d.*

3 6 8

3 6 8

100

100

---


$$101 \ 13 \ 4 : 100 :: 50 \\ \quad \quad \quad 3 \quad \quad \quad 3$$

---


$$103 \ 6 \ 8 : 100 :: 50 \\ \quad \quad \quad 3 \quad \quad \quad 3$$

---


$$305 \ 90 \ 0 \quad 300 \\ \quad \quad \quad 50$$

---


$$310 \ 0 \ 0 \quad 300 \\ \quad \quad \quad 50$$

---


$$305)15000(49 \ 3 \ 7\frac{1}{2} \\ \quad \quad \quad 1220$$

---


$$31,0)1500,0(48 \ 7 \ 8\frac{1}{2} \\ \quad \quad \quad 124$$

2800

2745

55

20

1100

915

185

12

2220

2135

85

4

340

305

*l. s. d.* 3549 3 7 $\frac{1}{2}$ 48 7 8 $\frac{1}{2}$ 


---

97 11 4 Ans.

260

248

12

20

240

217

23

12

276

248

28

4

112

93

19

[12]

The 1st and 2nd payments of this example will be the same as the last. For the 3rd,

<i>m.</i>	<i>l.</i>	<i>m.</i>	
12	5	12	
		5	
		<hr/>	
		12,60	
		<hr/>	
<i>£.</i>			<i>£.</i>
5			5
<hr/>			
100			
	<i>£.</i>	<i>£.</i>	
105	:	100	:: 50
			50
		<hr/>	
		<i>l.</i>	<i>s.</i>
		<i>d.</i>	
105	5000	(47	12 4½
	420		
	<hr/>		
	800		
	735		
	<hr/>		
	65		
	20		
	<hr/>		
	1300		
	105		
	<hr/>		
	250		
	210		
	<hr/>		
	40		
	12		
	<hr/>		
	480		
	420		
	<hr/>		
	60		
	4		
	<hr/>		
		<i>l.</i>	<i>s.</i>
		<i>d.</i>	
240		47	12 4½
210		97	11 4 the an. to the last
		<hr/>	
30	145	3	8½ Ans.

*m.* *l.* *m.* [13]

12 : 4 :: 2

4

12)8

*l.* *s.* *d.*

0 13 4

0 13 4

100

*l.*

*l.*

100 13 4 : 100 :: 100

3

3

302 0 0

300

100

*l.* *s.* *d.*

302)30000( 99 6 9

2718

2820

2718

102

20

2040

1812

228

12

2736

2718

18

*m.* *l.* *m.*

12 : 4 :: 5

4

12)20

*l.* *s.* *d.*

1 13 4

1 13 4

100

101 13 4 : 100 :: 50

3

3

305 0 0

300

50

*l.* *s.* *d.*

305)15000(49 3 7½

1220

2800

2745

55

20

1100

915

185

12

2220

2135

85

4

340

305

35

*m.* *l.* *m.*

12 : 4 :: 3

4

12)12

—

1

100

*l.*

*l.*

101 : 100 :: 50

100

*l.* *s.* *d.*

101)5000(49 10 1

404

960

909

51

20

1020

1010

10

12

120

101

10

*l.* *s.* *d.*

99 6 9

49 10 1

49 3 7½

198 0 5½ Ans.

# EQUATION OF PAYMENTS.

95

[14]

$$\begin{array}{r} m. \quad \$ \quad m. \\ 12 : 7 :: 6 \\ 7 \end{array}$$

$$12)42$$

$$\begin{array}{r} \$ \quad c. \\ \$ 3 \quad 50 \end{array}$$

$$\begin{array}{r} \$ \quad c. \\ 3 \quad 50 \end{array}$$

$$100$$

$$\begin{array}{r} \$ \quad \$ \quad c. \\ 103 \quad 50 : 100 :: 164 \quad 75 \end{array}$$

$$100$$

$$\begin{array}{r} \$ \quad c. \\ 1035,0)164750,0(159 \quad 17 \quad \frac{22}{1035} \\ 1035 \quad \text{Ans.} \end{array}$$

$$6125$$

$$5175$$

$$9500$$

$$9315$$

$$185$$

$$100$$

$$18500$$

$$1035$$

$$8150$$

$$7245$$

$$\begin{array}{r} 985 \\ 1835 \end{array}$$

# EQUATION OF PAYMENTS.

[1]

$$50 \times 2 = 100$$

$$50 \times 4 = 200$$

mo.

$$\begin{array}{r} 100 \\ 100)300(3 \text{ Ans.} \\ 300 \end{array}$$

[2]

$$50 \times 2 = 100$$

$$100 \times 5 = 500$$

$$150 \times 8 = 1200$$

mo.

$$\begin{array}{r} 300 \\ 300)1800(6 \text{ Ans.} \\ 1800 \end{array}$$

[3]

$$200 \times 0 = 0000$$

$$400 \times 5 = 2000$$

$$400 \times 10 = 4000$$

---


$$1000 \quad 1000)6000(6 \text{ Ans.}$$

$$6000$$


---

Suppose £ 12.

$$3 \times 2 = 6$$

$$3 \times 4 = 12$$

$$3 \times 6 = 18$$

$$3 \times 8 = 24$$

---


$$12 \quad 12)60(5 \text{ Ans.}$$

$$60$$


---

Suppose 12l.

$$4 \times 3 = 12$$

$$4 \times 6 = 24$$

$$4 \times 9 = 36$$

---


$$12 \quad 12)72(6 \text{ Ans.}$$

$$72$$


---

[6]

Suppose 12l.

$$6 \times 0 = 00$$

$$3 \times 4 = 12$$

$$3 \times 8 = 24$$

---


$$12 \quad 12)36$$


---

Ans. 3 months.

[7]

This comes under Inverse Proportion, and in words may stand thus :

If A lend B 420l. for 6 months, how long ought B to lend A 360l. to requite the favour ?

$$\begin{array}{rcl} \text{l.} & \text{mo.} & \text{l.} \\ 420 & : 6 & :: 360 \\ & 6 & \end{array}$$

---


$$360)2520(7 \text{ Ans.}$$

$$2520$$


---

## BARTER.

[1]

d. C. gr. d.

$$9 : 62 :: 14$$

$$14$$

---


$$9)910$$


---

Ans. 10 0 12 $\frac{1}{2}$  lb.

[2]

s. lb. s.

$$10 : 112 :: 4$$

$$4$$

---


$$10)448$$


---

Ans. 44lb. 12 $\frac{3}{10}$  oz.



$$\begin{array}{r}
 122 \\
 \underline{5} \\
 12)560 \\
 \hline
 \text{raisins per C.} \\
 46s. 8d. \text{ the price of the} \\
 \begin{array}{r}
 s. \quad C \text{ gr.} \quad s. \quad d. \\
 28 : 3 \ 2 :: 46 \ 8 \\
 12 \quad 4 \quad 12 \\
 \hline
 336 \quad 14 \quad 560 \\
 \hline
 14 \\
 \hline
 4 \\
 336)7840(23 \\
 672 \quad \hline
 \hline
 5C. 3gr. 9\frac{1}{3} \\
 1120 \quad \text{Ans.} \\
 1008 \\
 \hline
 112)336)112 \\
 \hline
 3) \ 1 \\
 28 \\
 \hline
 )28(9\frac{1}{3} \\
 \hline
 \begin{array}{r}
 s. \ d. \quad lb. \quad d. \quad [4] \\
 10 \ 8 : 560 :: 6 \\
 12 \quad 6 \\
 \hline
 \hline
 lb. \ oz. \\
 128 \ )3360(26 \ 4 \ \text{Ans.} \\
 256 \\
 \hline
 800 \\
 768 \\
 \hline
 32 \\
 16 \\
 \hline
 512 \\
 512
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 [5] \quad hhds. \\
 3 \\
 63 \\
 s. \ d. \quad \hline \quad s. \ d. \\
 6 \ 8 \mid \frac{1}{3})189 \text{ at } 6 \ 8 \\
 \hline
 63 \\
 20 \\
 \hline
 s. \\
 126)1260(10 \ \text{Ans.} \\
 1260 \\
 \hline
 [6] \quad C. \text{ gr.} \quad d. \quad C. \\
 1 \ 3 : 4 :: 12 \\
 4 \quad 4 \\
 \hline
 7 \quad 48 \\
 4 \\
 \hline
 7)192 \\
 \hline
 \text{Ans. } 27d. \frac{1}{4} + \frac{5}{7} \\
 \hline
 [7] \quad d. \quad s. \quad s. \ d. \\
 20 : 2 :: 14 \ 6 \\
 12 \\
 \hline
 174 \\
 2 \\
 \hline
 2,0)34,8 \\
 \hline
 \text{Ans. } 17s. 4d. \frac{3}{4} + \frac{4}{20}
 \end{array}$$

[8]      41  
           30  


---

 2,0)123,0  


---

       61 10  
       20  


---

       41 10  
       20  


---

       830  
       12  


---

 5)9960  


---

           *C. gr. lb.*  
 112)1992(17 3 4 Ans.  
       112  


---

       872  
       784  


---

       28)88  
        84  


---

        4

*s. s. d. d.*      [9]  
 6 : 6 6 :: 9  
 12 12  


---

 72 78  
       9  


---

           *d.*  
 72)702( $9\frac{3}{4}$  Price of the cot-  
       648      ton in barter.  


---

       54  
       4  


---

       216  
       216  


---

           100 doz.  
            6  


---

           600  
           12  


---

       9)7200  


---

           *C. gr. lb.*  
 112)800(7 16 the quan-  
       784      tity of cotton.  


---

       16

## LOSS AND GAIN.

[1]      28 s.  
           18  


---

 2,0)50,4  
       *£.25 4s. Prime cost.*  


---

           112 lb.  
           18  


---

 3 |  $\frac{1}{4}$  | 2016 at  $3\frac{1}{4}$   


---

 $\frac{1}{2}$  |  $\frac{1}{8}$  | 504  
       84  


---

 2,0)58 8  
       29 8 sold for.  
       25 4  


---

 Ans. *£. 4 4s. Gain.*

[2]      20d.  
           17  


---

       3 loss on each.  
       12  


---

       36 loss per doz.  
       120  


---

 12)4320  


---

 2,0)36,0  


---

       *£. 18 whole loss.*

[3]      s. d.

$$\begin{array}{r} 4 \ 9 \\ 4 \ 0 \\ \hline s. \quad \quad \quad \pounds. \\ 4 : 9 :: 100 \\ 12 \quad \quad \quad 9 \\ \hline 48 \quad \quad \quad 48)900 \\ \hline 12)225 \end{array}$$

Ans. £. 18 15s

[5]      15s.

$$\begin{array}{r} 60 \\ \hline 2,0)90,0 \\ \hline 45 \\ 4 \\ \hline 1,80 \\ 20 \\ \hline 16,00 \\ \hline \text{Ans. £. 1 16s.} \end{array}$$

[4]      19½ C.

$$\begin{array}{r} 19 \\ \hline 370\frac{1}{2} \\ 14 \\ \hline 2,0)518,7 \\ \hline \pounds. 259 \ 7s. \text{ Prime cost.} \end{array}$$

$$\begin{array}{r} C. \ gr. \\ 19 \ 2 \\ 19 \\ \hline 370 \ 2 \\ 4 \end{array}$$

$$\begin{array}{r} 1482 \\ 28 \end{array}$$

$$\begin{array}{r} 11856 \\ 2964 \end{array}$$

$$\begin{array}{r} 4 \left| \frac{1}{3} \right| 41496 \\ \hline 20)1383,2 \end{array}$$

$$\begin{array}{r} \pounds. 691 \ 12 \text{ sold for.} \\ 259 \ 7 \end{array}$$

Ans. £. 432 5 gain.

[6]

7 T.

4

28

17

£. 476 Prime cost.

hd.

28

63

84

168

1764

8

2,0)1411,2

£. 705 12s. Sold for.

£. s.

705 12

476 00

229 12 whole gain.

£. £. s. £.  
476 : 229 12 :: 100

10

2296

10

476)22960(48 4 8 $\frac{1}{4}$  +  $\frac{439}{176}$   
 - 1904 gain per cent.

3920

3808

112

20

2240

1904

336

12

4032

3808

224

. 4

896

476

480  
176

[7] 15d.  
500

£. 12)7500  
100  
9 2,0)62,5  
— £.  
91 : 9 :: 31 5  
9

— £. s. d.  
91)281 5(3 1 9 $\frac{1}{4}$  +  $\frac{3}{8}$   
273 Ans.

8  
20  
—  
165  
91  
—  
74  
12  
—

888  
819  
—  
69  
4  
—

276  
273  
—  
 $\frac{3}{8}$

[8] £. s.  
24 10  
20  
—  
2)490  
—

Ans. 245 stone.

[9] £.56  
19  
—  
75  
20  
—

1,00)15,00  
—

Ans. 15s. per yard.

£. £. £. [10]  
100 : 115 :: 56  
56

—  
690  
575  
—  
10,0)644,0  
—

64 8  
20  
—

— s. d.  
100)1288(12 10 $\frac{1}{2}$  +  $\frac{24}{100}$  Ans.  
1200

88  
12  
—

1056  
1000  
—

56  
4  
—

224  
200  
—  
 $\frac{24}{100}$

## SINGLE FELLOWSHIP.

A 3 £. [1]

B 7

— s. £.

10 : 25 :: 3

3

10)75

7s. 6d. = A's share.

l. s. l.

10 : 25 :: 7

7

10)175

17s. 6d. = B's share.

A 140 £. [2]

B 300

C 160

— £. £.

600 : 120 :: 140

140

6,00)168,00

£ 28 = A's share.

£. £. £.

600 : 120 :: 300

300

6,00)360,00

£ 60 = B's share.

£. £. £.

600 : 120 :: 160

160

6,00)192,00

£.32 = C's share.

A 1200 £. [3]

B 4800

C 2000

—	l.	l.
8000	: 800	:: 1200
	1200	

8,000)960,000

£.120 = A's loss.

£. £. £.

8000 : 800 :: 4800

4800

8,000)3840,000

£. 480 = B's loss.

£. £. £.

8000 : 800 :: 2000

2000

8,000)1600,000

£.200 = C's loss.

[4]      £.

3)600

Ans. £. 200 each.

<i>l.</i>	[5]	
480		
680		
840		
<hr/>		
	<i>£.</i>	<i>£.</i>
2000 :	1010 ::	480
590 :	1010 ::	120
	120	
<hr/>		
5,000)	1212,00	
<hr/>		

242*l.* 8*s.* = A's share.

<i>l.</i>	<i>l.</i>	<i>l.</i>
2000 :	1010 ::	680
	680	
<hr/>		
	80800	
	604	
<hr/>		
2,000)	684,800	
<hr/>		

343*l.* 8*s.* = B's share.

<i>l.</i>	<i>l.</i>	<i>l.</i>
2000 :	1010 ::	840
	840	
<hr/>		
	40400	
	808	
<hr/>		
2,000)	848,400	
<hr/>		

424*l.* 4*s.* = G's share.

[6]	<i>T.</i>	
A	48	
B	36	
C	24	
<hr/>		
	<i>T.</i>	<i>T.</i>
108 :	45 ::	48
9 :	45 ::	4
	4	
<hr/>		
9)	180	
<hr/>		

A 20 tons.

<i>T.</i>	<i>T.</i>	<i>T.</i>
108 :	45 ::	36
9 :	45 ::	3
	3	
<hr/>		
9)	135	
<hr/>		

B 15 tons.

<i>T.</i>	<i>T.</i>	<i>T.</i>
108 :	45 ::	24
9 :	45 ::	2
	2	
<hr/>		
9)	90	
<hr/>		

C 10 tons.

S 70	[7]	d.	d.	£.
T 400		146550	: 98328	:: 400
V 140 12 6			400	
	£.	s.	£.	£. s. d.
610 12 6	: 409 14	:: 70	146550)	39331200(268 7 7½
20	20		293100	
12212	8194		1002120	
12	12		879300	
146550	98328		1228200	
	70		1172400	
		l. s. d.		
146550)	6882960	(46 19 3¾	55800	
	586200		20	
	1020960		1116000	
	879200		1025850	
	141660		90150	
	20		12	
	2833200		1081800	
	146550		1025850	
	1367700		55950	
	1318950		4	
	48750		223800	
	12		146550	
	585000		77250	
	439650		146550	
	145350			
	4			
	581400			
	439650			
	141750			



# FELLOWSHIP.

105

<i>d.</i>	:	<i>d.</i>	::	<i>l.</i>	<i>s.</i>	<i>d.</i>
146550	:	98328	::	140	12	6
8						8

---

1172400	:	98328	::	1125	0	0
				1125		

---

491640  
196656  
1081608

---

	<i>l.</i>	<i>s.</i>	<i>d.</i>
11724,00)	1106190,09	(94	7 0 $\frac{1}{2}$
	105516		

---

51030  
46896

---

4134  
20

---

82680  
82068

---

612  
12

---

7344  
4

---

29376  
23448

---

8)  $\frac{592800}{1172400} = 74100$



COMPOUND FELLOWSHIP.

$$120 \times 9 = 1080$$

$$100 \times 16 = 1600$$

$$100 \times 14 = 1400$$

[1]

$$\begin{array}{r} \text{---} \quad \text{L.} \quad \text{L.} \\ 4080 : 100 :: 1080 \\ 1080 \end{array}$$

$$\begin{array}{r} \text{---} \quad \text{L.} \quad \text{s.} \quad \text{d.} \\ 4080) 108000 (26 \ 9 \ 4\frac{1}{2} \end{array}$$

8160

26400

24480

1920

20

38400

36720

1680

12

20160

16320

3840

4

15360

12240

3120

4080

$$\begin{array}{r} \text{L.} \quad \text{L.} \quad \text{L.} \\ 4080 : 100 :: 1600 \\ 1600 \end{array}$$

$$\begin{array}{r} \text{L.} \quad \text{s.} \quad \text{d.} \\ 4080) 160000 (39 \ 4 \ 3\frac{1}{2} \end{array}$$

12240

37600

36720

880

20

17600

16320

1280

12

15360

12240

3120

4

12480

12240

240

4080

$$\begin{array}{r} \text{L.} \quad \text{L.} \quad \text{L.} \\ 4080 : 100 :: 1400 \\ 1400 \end{array}$$

$$\begin{array}{r} \text{L.} \quad \text{s.} \quad \text{d.} \\ 4080) 140000 (34 \ 6 \ 3\frac{1}{2} \end{array}$$

12240

17600

16320

1280

20

25600

24480

1120

12

13440

12240

1200

4

4800

4080

720

4080

$$400 \times 9 = 3600$$

$$680 \times 5 = 3400$$

$$120 \times 12 = 1440$$

[2]

$$\begin{array}{r} L \quad L \quad L \\ 8440 : 500 :: 3400 \\ 500 \end{array}$$

$$\begin{array}{r} L \quad L \\ 8440 : 500 :: 3600 \\ 3600 \end{array}$$

$$\begin{array}{r} L \quad s. \quad d. \\ 8440)1800000(213 \ 5 \ 4\frac{1}{2} \\ 16880 \end{array}$$

$$11200$$

$$8440$$

$$27600$$

$$25320$$

$$2280$$

$$20$$

$$45600$$

$$42200$$

$$3400$$

$$12$$

$$40000$$

$$33760$$

$$7040$$

$$4$$

$$28160$$

$$25320$$

$$\begin{array}{r} 3140 \\ 1440 \end{array}$$

$$\begin{array}{r} L \quad s. \quad d. \\ 8440)1700000(201 \ 8 \ 5 \\ 16880 \end{array}$$

$$12000$$

$$8440$$

$$3560$$

$$20$$

$$71200$$

$$67520$$

$$3680$$

$$12$$

$$44160$$

$$42200$$

$$1960$$

$$4$$

$$7840$$

$$8440$$

$$\begin{array}{r} L \quad L \quad L \\ 8440 : 500 :: 1440 \\ 1440 \end{array}$$

$$\begin{array}{r} L \quad s. \quad d. \\ 8440)720000(85 \ 6 \ 1\frac{1}{2} \\ 67520 \end{array}$$

$$44800$$

$$42200$$

$$2600$$

$$20$$

$$52000$$

$$50640$$

$$1360$$

$$12$$

$$16320$$

$$8440$$

$$7880$$

$$4$$

$$31520$$

$$25320$$

$$6200$$

$$8440$$

$$40 \times 76 = 3040$$

$$36 \times 50 = 1800$$

$$50 \times 90 = 4500$$

---

9340

*l.*

$$9340 : 20 :: 3040$$

---

20

---

*l. s. d.*  
9340) 60800 (6 10 2½

---

56040

---

4760

---

20

---

95200

---

93400

---

1800

---

12

---

21600

---

18680

---

2920

---

4

---

11680

---

9340

---

2340

$$9340 : 20 :: 1800$$

---

20

---

*l. s. d.*  
9340) 36000 (3 17 1

---

28020

---

7980

---

20

---

159600

---

9340

---

66200

---

65380

---

820

---

12

---

9840

---

9340

---

500

---

4

---

2000

---

9340

$$9340 : 20 :: 4500$$

---

20

---

*l. s. d.*  
9340) 90000 (9 12 8½

---

84060

---

5940

---

20

---

118800

---

9340

---

25400

---

18680

---

6720

---

12

---

80640

---

74720

---

5920

---

4

---

23680

---

18680

---

5000

---

9340

# EXCHANGE.

## EXCHANGE.

*Case 1.*  
*d. P.E. l.* [1]  
 56 : 1 :: 63

20

1260

12

— *Pieces.*  
 56)15120(270 Ans.  
 112

392

392

0

*s. d.* [2] *s. d.*  
 4 0 |  $\frac{1}{3}$  | 1468 at 4 6 $\frac{1}{2}$   
 6 |  $\frac{1}{8}$  | 293 12  
 $\frac{1}{2}$  |  $\frac{1}{12}$  | 36 14  
 3 1 2

£. 333 7 2 Ans.

*s. d.* [3] *s. d.*  
 4 0 |  $\frac{1}{3}$  | 786 at 4 7  
 6 |  $\frac{1}{8}$  | 157 4  
 1 |  $\frac{1}{6}$  | 19 13  
 3 5 6

£. 180 2 6 Ans.

*Case 2.*

*li. £. li.* [1]  
 100 : 3 :: 1

20

60

12

— *d.*  
 100)720(7 $\frac{1}{3}$  Ans.  
 700

20)  $\frac{20}{100}$  ( $\frac{1}{5}$ )

*s. d.* [2] *s. d.*  
 4 0 |  $\frac{1}{3}$  | 2000 at 4 4  
 4 |  $\frac{1}{12}$  | 400  
 33 6 8

£. 433 6 8 Ans.

*s. d. Du. l.* [3]  
 4 4 : 1 :: 100  
 12 20  
 52 2000  
 12

— *Duc.*  
 52)24000(461 $\frac{2}{3}$  An.  
 208

320

312

80

52

28

52

*s. d. Du. l. s. d.* [4]  
 4 9 : 1 :: 233 16 8  
 12 20

57 4676  
 12

— *Duc.*  
 57)56120(984 $\frac{2}{3}$  An.  
 513

482

456

260

228

32

37

$$\begin{array}{r|l}
 s. d. & [5] \\
 4 \ 0 & \frac{1}{3} \quad 4000 \text{ at } 4 \ 6\frac{1}{4} \\
 \hline
 6 & \frac{1}{8} \quad 800 \\
 \frac{1}{4} & \frac{1}{24} \quad 100 \\
 \hline
 & 4 \ 3 \ 4
 \end{array}$$

£. 904 3 4 Ans.

$$\begin{array}{r}
 d. \quad Du. \quad l. \quad s. \quad d. \quad [6] \\
 54\frac{1}{4} : 1 :: 904 \ 3 \ 4 \\
 4 \quad \quad \quad 20 \\
 \hline
 217 \quad \quad \quad 18083 \\
 \quad \quad \quad 12 \\
 \hline
 \quad \quad \quad 217000 \\
 \quad \quad \quad 4 \\
 \hline
 \quad \quad \quad Du. \\
 217)868000(4000 \text{ An.} \\
 \quad \quad \quad 868 \\
 \hline
 \quad \quad \quad 000
 \end{array}$$

Case 3.

$$\begin{array}{r}
 s. d. \quad c. \quad £. \quad [1] \\
 4 \ 6 : 1 :: 200 \\
 12 \quad \quad \quad 20 \\
 \hline
 54 \quad \quad \quad 4000 \\
 \quad \quad \quad 12 \\
 \hline
 6)54)48000 \\
 \hline
 9)8000 \\
 \hline
 \text{Ans. } 888\frac{3}{8} \text{ F. Cr.}
 \end{array}$$

$$\begin{array}{r|l}
 s. d. & [2] \\
 4 \ 0 & \frac{1}{3} \quad 800 \text{ at } 4 \ 6 \\
 \hline
 6 & \frac{1}{8} \quad 160 \\
 \frac{1}{4} & \frac{1}{24} \quad 20 \\
 \hline
 & 180\% \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 [3] \quad 1000 \text{ at } 50d. \\
 \quad \quad \quad 50 \\
 \hline
 12)50000 \\
 \hline
 2,0)416,6 \ 8
 \end{array}$$

£. 208 6 8 Ans.

Case 4.

$$\begin{array}{r|l}
 s. d. & [1] \\
 6 \ 8 & \frac{1}{3} \quad 1432 \text{ at } 6 \ 8
 \end{array}$$

£. 477 6 8 Ans.

$$\begin{array}{r}
 s. d. \quad m.r. \quad l. \quad s. \quad d. \quad [2] \\
 6 \ 8 : 1 :: 1333 \ 6 \ 8 \\
 12 \quad \quad \quad 20 \\
 \hline
 80 \quad \quad \quad 26666 \\
 \quad \quad \quad 12
 \end{array}$$

8,0)32000,0

Ans. 4000 M. R.

$$\begin{array}{r}
 R. \quad s. d. \quad R. \quad [3] \\
 1000 : 5 \ 8 :: 4761764 \\
 \quad \quad \quad 12 \quad \quad \quad 272 \\
 \hline
 \quad \quad \quad 68 \quad \quad \quad 9523528 \\
 \quad \quad \quad 4 \quad \quad \quad 33332348 \\
 \hline
 \quad \quad \quad 9523528 \\
 272 \quad \quad \quad \hline
 1,000)1295199,808 \\
 4)1295199,808 \\
 \hline
 12)323799\frac{3}{4} \\
 2,0)2698,3 \ 3
 \end{array}$$

Ans. £. 1349 3 3 $\frac{3}{4}$  +  $\frac{808}{1000}$

[1] *Case 5.*  

$$\begin{array}{r} 53d. \\ 120 \\ \hline 12)6360 \\ \hline 2,0)53,0 \\ \hline \end{array}$$
  
*£. 26 10 Ans.*

[2]  

$$\begin{array}{r} d. \quad E. \quad l. \quad s. \quad d. \\ 53\frac{1}{2} : 1 :: 220 \quad 16 \quad 8 \\ 2 \qquad \qquad 20 \\ \hline 107 \qquad \qquad 4416 \\ \qquad \qquad \qquad 12 \\ \hline \qquad \qquad \qquad 53000 \\ \qquad \qquad \qquad 2 \\ \hline \end{array}$$

*Ecues.*  

$$\begin{array}{r} 107)106000(990\frac{70}{107} \text{ Ans.} \\ 963 \\ \hline 970 \\ 963 \\ \hline 70 \\ 107 \end{array}$$

[3]  

$$\begin{array}{r} s. \quad d. \qquad \qquad s. \quad d. \\ 5 \quad 0 \quad | \quad \frac{1}{2} \quad | \quad 1876 \text{ at } 5 \quad 3 \\ 3 \quad | \quad \frac{1}{20} \quad | \quad 469 \\ \qquad \qquad \qquad 23 \quad 9 \\ \hline \end{array}$$
  
*£. 492 9 Ans.*

*Case 6.*  
 [1]  

$$\begin{array}{r} fl. \quad l. \quad fl. \\ 20 : 3 :: 1 \\ 20 \\ \hline 2,0)6,0 \\ \hline \end{array}$$
  
*3s. Ans.*

[2]  

$$\begin{array}{r} d. \quad fl. \quad l. \\ 39 : 1 :: 1000 \\ 20 \\ \hline 20000 \\ 12 \\ \hline fl. \\ 39)240000(6153\frac{33}{39} \text{ An} \\ 234 \end{array}$$

[3]  

$$\begin{array}{r} s. \quad d. \\ 3 \quad 4\frac{1}{2} \\ 10 \\ \hline 1 \quad 13 \quad 9 \\ 10 \\ \hline 150 \\ 117 \\ \hline 33 \\ 38 \end{array}$$

[4]  

$$\begin{array}{r} s. \quad d. \\ 3 \quad 4\frac{1}{2} \\ 10 \\ \hline 1 \quad 13 \quad 9 \\ 10 \\ \hline \end{array}$$
  
*£. 16 17 6 Ans.*

[4]  

$$\begin{array}{r} d. \quad fl. \quad l. \quad s. \\ 41 : 1 :: 763 \quad 10 \\ 20 \\ \hline 15270 \\ 12 \\ \hline fl. \\ 41)183240(4469\frac{11}{41} \text{ An.} \\ 164 \\ \hline 192 \\ 164 \\ \hline 284 \\ 246 \\ \hline 380 \\ 369 \\ \hline 11 \\ 21 \end{array}$$



Case 7.

$$\begin{array}{r}
 \begin{array}{c} \text{[1]} \\ \text{s. d. l.} \\ 34 \ 6 : 1 :: 2000 \ 12 \ 6 \\ 12 \\ \hline 414 \end{array} \\
 \begin{array}{c} \text{[1]} \\ \text{l. s. d.} \\ 40012 \\ 12 \\ \hline 414 \end{array} \\
 \begin{array}{c} \text{l. s. d.} \\ 414)480150(1159 \ 15 \ 7\frac{1}{2} + \frac{126}{414} \\ 414 \\ \hline 661 \\ 414 \\ \hline 2475 \\ 2070 \\ \hline 4050 \\ 3726 \\ \hline 224 \\ 20 \\ \hline 6480 \\ 414 \\ \hline 2340 \\ 2070 \\ \hline 270 \\ 12 \\ \hline 3240 \\ 2898 \\ \hline 342 \\ 4 \\ \hline 1368 \\ 1242 \\ \hline \frac{126}{414} \end{array}
 \end{array}$$

$$\begin{array}{r}
 \begin{array}{c} \text{[3]} \\ \text{s. d. l. G. st.} \\ 37 \ 9 : 1 :: 3060 \ 15 \\ 12 \\ \hline 453 \end{array} \\
 \begin{array}{c} \text{[3]} \\ \text{l. s. d.} \\ 61215 \\ 2 \\ \hline 453)122430(270 \ 5 \ 3\frac{1}{2} + \frac{138}{453} \\ 906 \\ \hline 3183 \\ 3171 \\ \hline 120 \\ 20 \\ \hline 2400 \\ 2265 \\ \hline 135 \\ 12 \\ \hline 1620 \\ 1359 \\ \hline 261 \\ 4 \\ \hline 1044 \\ 906 \\ \hline \frac{138}{453} \end{array}
 \end{array}$$

$$\begin{array}{r}
 \text{[4]} \ \text{£.st.} \ \text{£.Fl.} \ \text{£.st.} \\
 120 : 147 :: 1
 \end{array}$$

$$\begin{array}{r}
 1 \\
 \hline
 120)147
 \end{array}$$

£. 1 4 6 Ans.

$$\begin{array}{r}
 \text{s. d.} \quad \text{[2]} \quad \text{l. s. d.} \\
 10 \ 0 \quad \left| \frac{1}{3} \right| \quad 1000 \text{ at } 1 \ 13 \ 4 \\
 3 \ 4 \quad \left| \frac{1}{3} \right| \quad 500 \\
 \hline
 166 \ 13 \ 4
 \end{array}$$

£. 1666 13 4 Ans.

$$\text{fl.} \quad \text{s.} \quad \text{d.} \quad \text{fl.}$$

$$1 : 3 \quad 2\frac{2}{5} :: 100$$

$$1 : 3 \frac{2}{k} :: 100$$

$$5. \quad 6. \quad 7. \\ 9 : 16 :: 1$$

12

38

5

192

100

5) 19200

12)3840

$$\begin{array}{r} 2,0 \overline{) 32,0} \end{array}$$

£. 16 Flem. = £. 9 ster.

*Reduction of current money of Holland into bank money ; and  
the contrary.*

**G.C. G.B. G.C.**

$$105 : 100 :: 1000$$

$$105\frac{1}{4} : 100 :: 27.63 \quad 15$$

1000

2 2 10

**G.B.**

105)  $100000(952\frac{40}{100})$  Ans.

**211 200 27637 10**

945

10

550

**276375**

525

2

250

**G. st.**

210

211)552750(2619 13.77

422

40

1307

1266

415

211

2040

1899

141

20

2820

211

710

633

77

G.C. G.B. G.C.  
105 : 100 :: 7681  
100

G.B. st. pen.  
105)768100(7315 4 12  $\frac{20}{100}$   
735

331  
315

160  
105

550  
525

25  
20

500  
420

80  
16

1280  
1260  
20

[3]

s. d. l. G. st. pen.  
35 6 : 1 :: 7315 4 12  
12 20  
426 146304  
8 16

3408 3408)2340876(686 17  $6\frac{1}{2}+$   
20448  
29607  
27264  
23436  
20448  
2988  
20  
59760  
3408  
25680  
23856  
1824  
12  
21888  
20448  
1440  
4  
5760  
3408  
2352

Ans.

s. d. l. G. st.  
33 8 : 1 :: 1090 17  
12 20  
404 21817  
2

[4]

l. s. d.  
404)43635(108 0  $1\frac{1}{2}+\frac{52}{100}$   
404

3235  
3232

3  
20

60  
12

720  
404

316  
4

1264  
1212

52

*Sale of Gold in Holland.*

*s.* [1] *l.* *s.*  
 5 |  $\frac{1}{4}$  | 1000 at 1 7  
 2 |  $\frac{1}{10}$  | 250  
       100

Charges 5 19 6

£. 1355 19 6

G. *st.*

100 : 5 :: 14209 14

20 : 1 :: 1

2,0) 14209 14

710 9

13499 5

*s.* *d.* *l.* G. *st.*

33 6 : 1 :: 13499 5

12 20

402 269985

2

402) 539970 (1343 4 2

402

1379

1206

1737

1608

1290

1206

84

20

1680

1608

72

12

864

804

*l.* *s.* *d.*

1355 19 6

1343 4 2

Ans. 12 15 4 loss.

*s.* *s.* *d.* *l.* *s.* [2]

20. : 34 6 :: 436 17

12 20

414 8737

414

34948

8737

34948

2,0) 361711,8

1,2) 180855  $\frac{3}{4}$  +  $\frac{12}{10}$

2,0) 1507,1 3

Ans. £. 753 11 3  $\frac{3}{4}$  +  $\frac{12}{10}$

20

15071

12

2) 180855  $\frac{3}{4}$  +

2,0) 9042,8

Ans. G. 4521 8 *st.* nearly.

*s. d. l.* *G. st.*  
 35 6 : 1 :: 7693 17  
 12 20

426 153877  
 2

426)307754(722 8 6½ + 60  
 2982

955

852

1034

852

182

20

3640

3408

232

12

2784

2556

228

4

912

852

60

[3]

To find the gain or loss  
 per cent. on the variation of  
 the price of Exchange.

*s. d. s. l.* [1]  
 34 6 : 1 :: 100  
 12 12 12

414)1200(2 17 11½ + 34½  
 828 gain per cent.

372

20

7440

414

3300

2898

402

12

4824

4554

270

4

1080

828

252

214

[2] This question is precisely  
 like the last ; and the answer is  
 2l. 17 11½ + 34½ loss per cent.

Case 8.

[1]

*£. £. £. s. d.*  
 3,00 : 1,00 :: 4960 17 6  
 1

3)4960 17 6

Ans. £. 1653 12 6 st.

[2]

*£. £. £. s. d.*  
 1,00 : 5,00 :: 120 6 9½  
 5

Ans. £. 601 13 11½

[3]

*£. £. £. s. d.*  
 4)100 : 125 :: 176 12 8  
 25 44 3 2

125 Ans. £. 220 15 10

[4]

*£. £. £. s. d.*  
 11,0 : 10,0 : 400 17 9  
 10

11)4008 17 6

Ans. £. 364 8 10½ + 5

[5]

£. s. d.  
364 8 10½  
8½

2915 11 0  
182 4 5½

30,97 15 5½  
20

19,55  
12

6,65  
4

2,61

£. s. d.  
364 8 10½  
30 19 6½ +  $\frac{61}{100}$

Ans. 395l. 8 5 +  $\frac{61}{100}$  gr.

Case 9.

d. R.D. £. s. d. [1]  
53 : 1 :: 796 10 6  
20

15930  
12

Rix dol.

53)191166(3606 $\frac{48}{33}$  Ans.  
159

321  
318

366  
318  
48  
73

[2]

li. d. li.  
3 : 56 :: 1960  
56

11760  
9800

3)109760

12)36586½ +  $\frac{2}{3}$

2,0)304,8 10

Ans. £. 152 8 10½ +  $\frac{2}{3}$

d. R.D. £. s. d. [3]  
58 : 1 :: 376 11 8  
20

7531  
12

Rix dol.

58)90380(1558 $\frac{16}{11}$  Ans.  
58

323  
290

338  
290

480  
464

16  
58

Case 10.

d. R.D. £. s. d. [1]  
50 : 1 :: 184 16 7  
20

3696  
12

5,0)4435,9

Ans. 887 $\frac{9}{11}$  Rix Dolls.

[2]

1000.  
58½

58000  
500

12)58500

2,0)487,5

£.243 15 Ans.

d. R.D. £. [3]  
55 : 1 :: 400  
20

8000  
12

5)55)96000

11)19200

1745<sup>5</sup>/<sub>11</sub> Rix Dol.

s. d.

4 0 | <sup>1</sup>/<sub>5</sub> | 1745½ at 4 6

6 | <sup>1</sup>/<sub>8</sub> | 349

43 12 6

2 3 = ½ R.D.

392 14 9

400 00 0

4)7 5 3 whole  
loss.

1 16 3½ loss per  
cent.

Case 11.

1184

6

2,0)710,4

£. 355 4s. Ans.

C.D. l. R.D.  
25 : 1 :: 1276

6

l. s. d.

25)7656(306 4 9½ + ⅔

75

156

150

6

20

120

100

20

12

240

225

15

4

60

50

<sup>10</sup>/<sub>23</sub> = <sup>2</sup>/<sub>5</sub>

C.D. s. R.D.

25 : 5 :: 1276

6

5 : 1 :: 5)7656

2,0)153,1 2½ + ⅔

Loss £.16 11 2½ + ⅔

[1]

Case 12.

b.V. E.E. b.V.

[3]

Comparison of Weights and Measures.

108 : 100 :: 1000

1000

lb. Lis. lb. Lon. lb. Lis. [1]

99 : 112 :: 1049

112

2098

11539

lb. Lon.

99)117488(1186 $\frac{74}{99}$ 

99 Ans.

184

99

858

792

668

594

74

19

lb. Lon. lb. R. lb. Lon. [2]

112 : 98 :: 1000

1000

lb. R.

112)98000(875 Ans.

896

840

784

560

560

E.E. gr. n.

108)100000(925 4 2 $\frac{56}{108}$ 

972

Ans.

280

216

640

540

100

5

500

432

68

4

272

216

56

E.L. E.V. E.L. [4]

100 : 145 :: 10

10

1,00)14,50

14 $\frac{50}{100}$  = 14 $\frac{1}{2}$  E.V. Ans.REDUCTION OF THE CURRENCIES  
OF THE UNITED STATES.

Case 1.

l. s. d. [1]

16)32 12 6

2 0 9 $\frac{1}{2}$ 30 11 8 $\frac{1}{2}$  Ans.

l. s. d. [2]

4)32 12 6

8 3 1 $\frac{1}{2}$ 24 9 4 $\frac{1}{2}$  Ans.



$$\begin{array}{r} \text{l. s. d.} \quad [3] \\ 32 \ 12 \ 6 \\ 7 \end{array}$$

$$12)228 \ 7 \ 6$$

$$19 \ 0 \ 7\frac{1}{2} \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \quad [4] \\ 4)32 \ 12 \ 6 \\ 8 \ 3 \ 1\frac{1}{2} \end{array}$$

$$4)24 \ 9 \ 4\frac{1}{2} \\ 6 \ 2 \ 4$$

$$18 \ 7 \ 0\frac{1}{2} \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \quad [5] \\ 15)32 \ 12 \ 6 \\ 2 \ 3 \ 6 \end{array}$$

$$34 \ 16 \ 0 \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \quad [6] \\ 5)32 \ 12 \ 6 \\ 6 \ 10 \ 6 \end{array}$$

$$26 \ 2 \ 0 \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \quad [7] \\ 32 \ 12 \ 6 \\ 4 \end{array}$$

$$130 \ 10 \ 0 \\ 7$$

$$5)913 \ 10 \ 0$$

$$9)182 \ 14 \ 0$$

$$20 \ 6 \ 0 \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \quad [8] \\ 32 \ 12 \ 6 \\ 3 \end{array}$$

$$5)97 \ 17 \ 6$$

$$19 \ 11 \ 6 \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \quad [9] \\ 3)32 \ 12 \ 6 \\ 10 \ 17 \ 6 \end{array}$$

$$43 \ 10 \ 0 \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \quad [10] \\ 4)32 \ 12 \ 6 \\ 8 \ 3 \ 1\frac{1}{2} \end{array}$$

$$40 \ 15 \ 7\frac{1}{2} \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \quad [11] \\ 32 \ 12 \ 6 \\ 7 \end{array}$$

$$9)228 \ 7 \ 6$$

$$25 \ 7 \ 6 \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \quad [12] \\ 4)32 \ 12 \ 6 \\ 8 \ 3 \ 1\frac{1}{2} \end{array}$$

$$24 \ 9 \ 4\frac{1}{2} \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \quad [13] \\ 32 \ 12 \ 6 \\ 12 \end{array}$$

$$7)391 \ 10 \ 0$$

$$55 \ 18 \ 6\frac{3}{4} \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \\ 32 \ 12 \ 6 \\ 5 \end{array} \quad [14]$$

$$\begin{array}{r} 163 \ 2 \ 6 \\ 9 \end{array}$$

$$4)1468 \ 2 \ 6$$

$$7)367 \ 0 \ 7\frac{1}{2}$$

$$52 \ 8 \ 7\frac{3}{4} \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \\ 32 \ 12 \ 6 \\ 9 \end{array} \quad [15]$$

$$7)293 \ 12 \ 6$$

$$41 \ 18 \ 11\frac{1}{7} \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \\ 32 \ 12 \ 6 \\ 4 \end{array} \quad [16]$$

$$\begin{array}{r} 130 \ 10 \ 0 \\ 7 \end{array}$$

$$3)913 \ 10 \ 0$$

$$9)304 \ 10 \ 0$$

$$33 \ 16 \ 8 \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \\ 3)32 \ 12 \ 6 \\ 10 \ 17 \ 6 \end{array} \quad [17]$$

$$\begin{array}{r} 3)43 \ 10 \ 0 \\ 14 \ 10 \ 0 \end{array}$$

$$58 \ 0 \ 0 \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \\ 32 \ 12 \ 6 \\ 5 \end{array} \quad [18]$$

$$3)163 \ 2 \ 6$$

$$54 \ 7 \ 6 \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \\ 3)32 \ 12 \ 6 \\ 10 \ 17 \ 6 \end{array} \quad [19]$$

$$43 \ 10 \ 0 \text{ Ans.}$$

$$\begin{array}{r} \text{l. s. d.} \\ 32 \ 12 \ 6 \\ 3 \end{array} \quad [20]$$

$$97 \ 17 \ 6$$

9

$$4)880 \ 17 \ 6$$

$$7)220 \ 4 \ 4\frac{1}{2}$$

$$31 \ 9 \ 2\frac{1}{2} \text{ Ans.}$$

Case 2.

$$\begin{array}{r|l} 4 & 1000 \\ 12 & 7250 \\ 20 & 14604 \\ & 19730 \\ & 5 \end{array} \quad [1]$$

$$2)98650$$

$$549 \ 32 \ 5m. \text{ Ans.}$$

$$\begin{array}{r|l}
 4 & 3000 \\
 12 & 7750 \\
 20 & 1645 \\
 & 74082 \\
 & 8
 \end{array}
 \quad [2]$$

$$3)592656$$

$$\text{£ } 197 \ 55 \ 2m. \text{ Ans.}$$

$$\begin{array}{r|l}
 4 & 1000 \\
 12 & 1250 \\
 20 & 0104 \\
 & 23005 \\
 & 10
 \end{array}
 \quad [3]$$

$$3)230050$$

$$\text{£ } 76 \ 68 \ 3m. \text{ Ans.}$$

$$\begin{array}{r|l}
 4 & 3000 \\
 12 & 0750 \\
 20 & 17062 \\
 & 63853 \\
 & -30
 \end{array}
 \quad [4]$$

$$7)1915590$$

$$\text{£ } 273 \ 65 \ 5m. \text{ Ans.}$$

$$\begin{array}{r|l}
 4 & 2000 \\
 12 & 3500 \\
 20 & 13291 \\
 & 13664 \\
 & 40
 \end{array}
 \quad [5]$$

$$9)546560$$

$$\text{£ } 60 \ 72 \ 8m. \text{ Ans.}$$

Case 3.

m. [1]

$$73430$$

$$2$$

$$5)146860$$

$$29,372$$

$$20$$

$$7,440$$

$$12$$

$$5,280$$

$$4$$

$$1,120$$

$$\text{Ans. £. } 29 \ 7 \ 5\frac{1}{4}$$

m. [2]

$$95864$$

$$3$$

$$8)287592$$

$$35,949$$

$$20$$

$$18,980$$

$$12$$

$$11,760$$

$$4$$

$$3,040$$

$$\text{Ans. £. } 35 \ 18 \ 11\frac{3}{4}$$

$$\begin{array}{r}
 m. \quad [3] \\
 49000 \\
 \quad 3 \\
 \hline
 10)147000 \\
 \underline{14,700} \\
 \quad 20 \\
 \hline
 \underline{14,000} \\
 \text{Ans. } £.14 \ 14s.
 \end{array}$$

$$\begin{array}{r}
 m. \quad [4] \\
 164780 \\
 \quad 7 \\
 \hline
 3,0)115346,0 \\
 \underline{38,448} \\
 \quad 20 \\
 \hline
 \underline{8,960} \\
 \quad 12 \\
 \hline
 \underline{11,520} \\
 \quad 4 \\
 \hline
 \underline{2,080} \\
 \text{Ans. } £.38 \ 8 \ 11\frac{1}{2}
 \end{array}$$

$$\begin{array}{r}
 m. \quad [5] \\
 47588 \\
 \quad 9 \\
 \hline
 4,0)42829,2 \\
 \hline
 10,707 \\
 \quad 20 \\
 \hline
 14,140 \\
 \quad 12 \\
 \hline
 1,680 \\
 \quad 4 \\
 \hline
 2,720 \\
 \text{Ans. } £.10 \ 14 \ 1\frac{1}{2}
 \end{array}$$

## DOUBLE RULE OF THREE.

$$\begin{array}{rcl}
 m. & da. & ac. \\
 7 : 12 :: 84 & \left. \begin{array}{l} 7 \times 12 \times 100 \\ 84 \times 5 \end{array} \right\} & \begin{array}{l} 8400 \text{ men.} \\ 420 \end{array} \\
 - & 5 :: 100 & \hline
 \end{array} = 20 \text{ Ans.}$$

\* Solutions of this nature may be done more briefly by canceling; but the difficulty of procuring types prevents its introduction in this work. The learner, however, is to observe to practice it whenever he can. The following is a specimen of this manner.

$$\begin{array}{rcl}
 m. & da. & ac. \\
 7 : 12 :: 84 & \left. \begin{array}{l} 7 \times 12 \times 100 \\ 84 \times 5 \end{array} \right\} & \begin{array}{l} 8400 \text{ men.} \\ 420 \end{array} \\
 - & 5 :: 100 & \hline
 \end{array} = 20 \text{ Ans.}$$

$$\begin{array}{l} \text{mc. mo. grs.} \\ 7 : 4 :: 7 \end{array} \left. \begin{array}{l} [2] \\ 7 \times 46 \times 10 \quad 3220 \text{ grs.} \\ \hline 7 \times 4 \quad 28 \end{array} \right\} = 115 \text{ Ans.}$$

$$\begin{array}{l} \text{R. Da. s.} \\ 8 : 4 :: 64 \end{array} \left. \begin{array}{l} [3] \\ 64 \times 48 \times 16 \quad 49152 \text{ s. l. s.} \\ \hline 8 \times 4 \quad 32 \end{array} \right\} = 1536 = 76 \text{ 16 Ans.}$$

$$\begin{array}{l} \text{h. da. bu.} \\ 18 : 20 :: 10 \end{array} \left. \begin{array}{l} [4] \\ 10 \times 60 \times 36 \quad 21600 \text{ bu.} \\ \hline 18 \times 20 \quad 360 \end{array} \right\} = 60 \text{ Ans.}$$

$$\begin{array}{l} \text{h. da. m.} \\ 12 : 12 :: 240 \end{array} \left. \begin{array}{l} [5] \\ 12 \times 12 \times 720 \quad 103680 \text{ days.} \\ \hline 240 \times 16 \quad 3840 \end{array} \right\} = 27 \text{ Ans.}$$

$$\begin{array}{l} \text{m. da. lb.} \\ 7 : 14 :: 56 \end{array} \left. \begin{array}{l} [6] \\ 56 \times 21 \times 3 \quad 3528 \text{ lb.} \\ \hline 7 \times 14 \quad 98 \end{array} \right\} = 36 \text{ Ans.}$$

$$\begin{array}{l} \text{£. mo. £.} \\ 700 : 6 :: 14 \end{array} \left. \begin{array}{l} [7] \\ 14 \times 400 \times 60 \quad 336000 \text{ £.} \\ \hline 700 \times 6 \quad 4200 \end{array} \right\} = 80 \text{ Ans.}$$

$$\begin{array}{l} \text{m. d. s.} \\ 8 : 3 :: 30 \end{array} \left. \begin{array}{l} [8] \\ 8 \times 3 \times 300 \quad 7200 \text{ da.} \\ \hline 30 \times 20 \quad 600 \end{array} \right\} = 12 \text{ Ans.}$$

$$\begin{array}{l} \text{m. da. s.} \\ 4 : 3 :: 24 \end{array} \left. \begin{array}{l} [9] \\ 4 \times 3 \times 96 \quad 1152 \text{ men.} \\ \hline 24 \times 16 \quad 384 \end{array} \right\} = 3 \text{ Ans.}$$

$$\begin{array}{l} \text{£. mo. £. s. d. l. s. d.} \\ 86 : 8 :: 2 \text{ 17 } 4 \end{array} \left. \begin{array}{l} [10] \\ 2 \text{ 17 } 4 \times 100 \times 12 \quad 3440 \text{ £.} \\ \hline 86 \times 8 \quad 688 \end{array} \right\} = 5 \text{ Ans.}$$

$$\begin{array}{l} \text{£. mo. £.} \\ 100 : 12 :: 4 \end{array} \left. \begin{array}{l} [11] \\ 5 \times 200 \times 45 \quad 45000 \text{ l. s.} \\ \hline 100 \times 12 \quad 1200 \end{array} \right\} = 37 \text{ 10 Ans.}$$

[12]

$$\begin{array}{rcl}
 \text{£.} & \text{we.} & \text{£.} \\
 100 : 52 :: 5 & \left\{ \begin{array}{l} 5 \times 400 \times 1 \\ 100 \times 52 \end{array} \right. & \begin{array}{l} 20,00 \\ 52,00 \end{array} \\
 400 : 1 - & & \begin{array}{l} 20 \\ 52 \end{array}
 \end{array}
 \quad \begin{array}{l} \text{£.} \quad \text{s.} \\ 20 \quad 400 \quad \text{s.} \quad \text{d.} \\ \hline = 7 \quad 8\frac{1}{2} + \frac{1}{2} \end{array}$$

Ans.

[13]

$$\begin{array}{rcl}
 \text{£.} & \text{Da.} & \text{£.} \\
 100 : 365 :: 4 & \left\{ \begin{array}{l} 4 \times 120 \times 126 \\ 100 \times 365 \end{array} \right. & \begin{array}{l} 60480 \\ 36500 \end{array} \\
 120 : 126 - & & \begin{array}{l} \text{l. s. d.} \\ 60480 \end{array}
 \end{array}
 \quad \begin{array}{l} \hline = 1 \quad 13 \quad 1\frac{1}{2} + \frac{25}{365} \end{array}$$

Ans.

## CONJOINED PROPORTION.

Case 1.

[1]

100 lb. Eng. = 95 lb. Fl.

19 lb. Fl. = 25 lb. Bol.

50 lb. Bol.

$$100 \times 19 \times 50 = 95000$$

$$\frac{95000}{95 \times 25} = 40 \text{ lb. Eng. Ans.}$$

$$95 \times 25 = 2375$$

[2]

25 lb. Lo. = 22 lb. Nu.

88 lb. Nu. = 92 lb. Ha.

46 lb. Ha. = 49 lb. Ly.

98 lb. Ly.

$$\begin{array}{r}
 25 \times 88 \times 46 \times 98 \\
 \hline
 22 \times 92 \times 49
 \end{array}
 = 100 \text{ lb. Lo.}$$

Ans.

[3]

6 b. Leg. = 3 c. Eng.

5 c. Eng. = 9 b. Ven.

45 b. Ven.

$$\begin{array}{r}
 6 \times 5 \times 45 \\
 \hline
 3 \times 9
 \end{array}
 = 50 \text{ b. Leg.}$$

Ans.

[4]

3 c. Eng. = 6 b. Leg.

150 b. Leg. = 135 b. Ven.

27 b. Ven.

$$\begin{array}{r}
 3 \times 150 \times 27 \\
 \hline
 6 \times 135
 \end{array}
 = 15 \text{ c. Eng. Ans.}$$

$$\begin{array}{r}
 6 \times 135 \\
 \hline
 2 \times 15
 \end{array}
 = 1$$

\* The 88, 46, 98, 2, 22, 92, 2 and 49 are left uncanceled for want of types. See note to 1st example in the Double Rule of Three. This method will frequently occur in the following pages.

Case 2.

[1]

10 lb. Lon. = 9 lb. Am.  
90 lb. Am. = 112 lb. Th.  
50 lb. Lon.

$$\begin{array}{r} \overset{1}{9} \times \overset{56}{112} \times \overset{1}{50} = 56 \text{ lb. Th.} \\ \hline 10 \times 90 = 900 \\ \hline \frac{900}{21} = 42 \frac{6}{7} \text{ Ans.} \end{array}$$

[2]

20 b. Leg. = 10 v. Lis.  
40 v. Lis. = 80 b. Luc.  
100 b. Leg.

$$\begin{array}{r} 10 \times \overset{2}{80} \times \overset{5}{100} = 100 \text{ b. Luc.} \\ \hline 20 \times 40 = 800 \\ \hline \frac{800}{6} = 133 \frac{1}{3} \text{ Ans.} \end{array}$$

ALLIGATION MEDIAL.

[1]

19 at 6 = 114  
40 at 4 = 160  
12 at 3 = 36  
— s. d.  
71 71)310(4  $4\frac{1}{2} + 4\frac{1}{2}$  Ans.

284

26

12

312

284

28

4

112

71

$4\frac{1}{2}$

[2]

20 at 2 = 40  
30 at 2 = 60  
20 at 3 = 60

70 7,0)16,0

s.2 d. $3\frac{1}{4} + \frac{1}{2}$  Ans.

[3]

5 at 8 = 40  
6 at 7 = 42  
4 at 6 = 24

15 15)106

s.7 d. $0\frac{3}{4} + \frac{1}{3}$  Ans.

[4]

C. s. s.  
2 at 56 = 112  
1 at 43 = 43  
2 at 50 = 100

— C.  
5 : 255 :: 3  
3

5)765

2,0)15,3

s.7 13s. Ans.

<i>Gal.</i>	<i>d.</i>	<i>d.</i>	[5]	3 of 22 = 66	[7]
12	at 6	= 72		3 of 20 = 60	
16	at 7	= 112		—	—
21	at 9	= 189		6	6)126

— *d.*  
49 49)373( $7\frac{1}{2} + \frac{22}{49}$ ) Ans. 21 Ans.

343

30

4

120

98

22

<i>oz.</i>	<i>oz.</i>	[6]	<i>s. d.</i>	[8]
5	of 8	= 40	1	at 5 0
10	of 7	= 70	1	at 3 6
15	of 6	= 90	—	—
30	3,0)	20,0	2	2)8 6

4 3 Ans.

*s. d.* [9]

1 at 4 6

1 at 4 0

1 at 3 6

3 3)12 0

6 13 *dwt.* 8 *gr.* An. 4 0 Ans.

<i>s.</i>	[10]	<i>s. d.</i>
1	at 20	27 6
1	at 25	12
1	at 30	— <i>d.</i>
1	at 35	32)330( $10\frac{1}{2} + \frac{8}{32}$ per gal.
4	4)110	320

27s. 6d. per bar.

10

4

40

32

8

32

## ALLIGATION ALTERNATE.

Case 1.

[1]	<i>Bu.</i>	[3]	<i>lb. d.</i>
30 { 48 )	6 = 6 rye.	8 { 10 )	1 + 2 = 3 at 10
30 { 36 )	6 = 6 barley	8 { 7 )	2 = 2 at 7
30 { 24 )	18 + 6 = 24 oats.	8 { 6 )	2 = 2 at 6

[2]	<i>lb.</i>
6 { 7 )	2 raisins of the Sun.
6 { 4 )	1 Malaga.



[4] *Bush. s. d.*

30 {	48	6	=6 at 4 0
	42	6	=6 at 3 6
	36	6	=6 at 3 0
	24	18+12+6=36	at 2 0

[5] *lb. s.*

10 {	12	2 at 12	10 {	12	1+2=3 at 12
	11	1 at 11		11	2 =2 at 11
	9	1 at 9		9	2 =2 at 9
	8	2 at 8		8	2+1=3 at 8

*lb. s.*

10 {	12	1 at 12	10 {	12	1 =1 at 12
	11	2 at 11		11	1+2=3 at 11
	9	2 at 9		9	2+1=3 at 9
	8	1 at 8		8	1 =1 at 8

*lb. s.*

10 {	12	1+2=3 at 12	10 {	12	2 =2 at 12
	11	1 =1 at 11		11	1+2=3 at 11
	9	2+1=3 at 9		9	1 =1 at 9
	8	2 =2 at 8		8	2+1=3 at 8

*lb. s.*

10 {	12	1+2=3 at 12	10 {	12	2 =2 at 12
	11	1+2=3 at 11		11	1+2=3 at 11
	9	2+1=3 at 9		9	1 =1 at 9
	8	2+1=3 at 8		8	2+1=3 at 8

[6] *oz.*

8 {	10	8 bullion with
	0	2 alloy.

Case 2.

ALTERNATION PARTIAL.

[1] *b. p.*

28 {	48	16	16 : 4 :: 10 : 2 2 rye.*	
	36	4		
	24	8		16 : 8 :: 10 : 5 0 barley.
	12	20		16 : 20 :: 10 : 12 2 oats.

*b.*

28 {	48	4+16=20	20 : 16 :: 10 : 8 rye.	
	36	16 =16		20 : 20 :: 10 : 10 barley.
	24	20 =20		20 : 28 :: 10 : 14 oats.
	12	20 +8=28		

*b.*

28 {	48	4	4 : 16 :: 10 : 40 rye.	
	36	16		4 : 20 :: 10 : 50 barley.
	24	20		4 : 8 :: 10 : 20 oats.
	12	8		

\* To work each of these proportions were superfluous. The reader will readily see how they are done.

28	{	48	4 = 4	b.	
		36	4+16=20		4 : 20 :: 10 : 50 rye.
		24	20+8=28		4 : 28 :: 10 : 70 barley.
		12	8 = 8		4 : 8 :: 10 : 20 oats.
28	{	48	4+16=20	b.	
		36	4 = 4		20 : 4 :: 10 : 2 rye.
		24	20+8=28		20 : 28 :: 10 : 14 barley.
		12	20 = 20		20 : 20 :: 10 : 10 oats.
28	{	48	16 = 16	b. p.	
		36	4+16=20		16 : 20 :: 10 : 12 2 rye.
		24	8 = 8		16 : 8 :: 10 : 5 0 barley.
		12	20+8=28		16 : 28 :: 10 : 17 2 oats.
28	{	48	4+16=20	b.	
		36	4+16=20		20 : 20 :: 10 : 10 rye.
		24	20+8=28		20 : 28 :: 10 : 14 barley.
		12	20+8=28		20 : 28 :: 10 : 14 oats.
22	{	18	8+14+26=48	[2] b.	
		30	4=		4 48 : 4 :: 12 : 1 barley.
		36	4=		4 48 : 4 :: 12 : 1 rye.
		48	4=		4 48 : 4 :: 12 : 1 wheat.
33	{	18	15	[3] b. p.	
		30	3		15 : 3 :: 12 : 2 $1\frac{2}{3}$ barley.
		36	3		15 : 3 :: 12 : 2 $1\frac{2}{3}$ rye.
		48	15		15 : 15 :: 12 : 12 0 wheat.
33	{	18	3+15=18	b.	
		30	15 = 15		18 : 15 :: 12 : 10 barley.
		36	15 = 15		18 : 15 :: 12 : 10 rye.
		48	15+3=18		18 : 18 :: 12 : 12 wheat.
33	{	18	3	b.	
		30	15		3 : 15 :: 12 : 60 barley.
		36	15		3 : 15 :: 12 : 60 rye.
		48	3		3 : 3 :: 12 : 12 wheat.
33	{	18	3 = 3	b.	
		30	3+15=18		3 : 18 :: 12 : 72 barley.
		36	15+3=18		3 : 18 :: 12 : 72 rye.
		48	3 = 3		3 : 3 :: 12 : 12 wheat.
33	{	18	3+15=18	b.	
		30	3 = 3		18 : 3 :: 12 : 2 barley.
		36	15+3=18		18 : 18 :: 12 : 12 rye.
		48	15 = 15		18 : 15 :: 12 : 10 wheat.

33	{	18	15 = 15		15 : 18 :: 12 : 14	b. p.	1 $\frac{2}{15}$ barley.
		30	3 + 15 = 18				
		36	3 = 3				
		48	15 + 3 = 18				
33	{	18	3 + 15 = 18		18 : 18 :: 12 : 12	b.	barley.
		30	3 + 15 = 18				
		36	15 + 3 = 18				
		48	15 + 3 = 18				
42	{	18	6 = 6		6 : 6 :: 12 : 12	b.	barley.
		30	6 = 6				
		36	6 = 6				
		48	24 + 12 + 6 = 42				
24	{	18	6 + 12 + 24 = 42		42 : 6 :: 28 : 4	b.	barley.
		30	6 = 6				
		36	6 = 6				
		48	6 = 6				
20	{	18	8 + 10 = 18		18 : 2 :: 27 : 3	b.	oats.
		28	2 = 2				
		30	2 = 2				

Case 3.

ALTERNATION TOTAL.

[1]

lb. d.

5	{	8	3		8 : 112 :: 3 : 42	at 8
		6	1		8 : 112 :: 1 : 14	at 6
		4	1		8 : 112 :: 1 : 14	at 4
		2	3		8 : 112 :: 3 : 42	at 2

8

112

5	{	8	1+3=4		14 : 112 :: 4 : 32	lb. at 8d.
		6	3 = 3		14 : 112 :: 3 : 24	at 6
		4	3 = 3		14 : 112 :: 3 : 24	at 4
		2	3+1=4		14 : 112 :: 4 : 32	at 2

14

112

5	{	8	1		8 : 112 :: 1 : 14	lb. at 8d.
		6	3		8 : 112 :: 3 : 42	at 6
		4	3		8 : 112 :: 3 : 42	at 4
		2	1		8 : 112 :: 1 : 14	at 2

8

112

				<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	<i>d.</i>
5	8	1 = 1	10 : 112 :: 1 : 11	3	3	$\frac{2}{10}$	at 8
	6	1+3=4	10 : 112 :: 4 : 44	12	12	$\frac{8}{10}$	at 6
	4	3+1=4	10 : 112 :: 4 : 44	12	12	$\frac{8}{10}$	at 4
	2	1 = 1	10 : 112 :: 1 : 11	3	3	$\frac{2}{10}$	at 2
		<hr/>					
		10		112	0	0	

				<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	<i>d.</i>
5	8	1+3=4	12 : 112 :: 4 : 37	5	5	$\frac{4}{12}$	at 8
	6	1 = 1	12 : 112 :: 1 : 9	5	5	$\frac{4}{12}$	at 6
	4	3+1=4	12 : 112 :: 4 : 37	5	5	$\frac{4}{12}$	at 4
	2	3 = 3	12 : 112 :: 3 : 28	0	0		at 2
		<hr/>					
		12		112	0	0	

				<i>lb.</i>	<i>oz.</i>	<i>dr.</i>	<i>d.</i>
5	8	3 = 3	12 : 112 :: 3 : 28	0	0		at 8
	6	1+3=4	12 : 112 :: 4 : 37	5	5	$\frac{4}{12}$	at 6
	4	1 = 1	12 : 112 :: 1 : 9	5	5	$\frac{4}{12}$	at 4
	2	3+1=4	12 : 112 :: 4 : 37	5	5	$\frac{4}{12}$	at 2
		<hr/>					
		12		112	0	0	

				<i>lb.</i>	<i>d.</i>
5	8	1+3=4	16 : 112 :: 4 : 28	at 8	
	6	1+3=4	16 : 112 :: 4 : 28	at 6	
	4	3+1=4	16 : 112 :: 4 : 28	at 4	
	2	3+1=4	16 : 112 :: 4 : 28	at 2	
		<hr/>			
		16		112	

9	10	1+3+5=9	[2] 12 : 60 :: 9 : 45	Canary.	
	8	1 = 1	12 : 60 :: 1 : 5	Malaga.	
	6	1 = 1	12 : 60 :: 1 : 5	Rhenish.	
	4	1 = 1	12 : 60 :: 1 : 5	Oporto.	
		<hr/>			
		12		60	

					<i>d.</i>
7	10	1 = 1	[3] 6 : 30 :: 1 : 5	at 10	
	8	1 = 1	6 : 30 :: 1 : 5	at 8	
	6	3+1=4	6 : 30 :: 4 : 20	at 6	
		<hr/>			
		6		30	

[4]

$$\begin{array}{rcl}
 20 \left\{ \begin{array}{l} 24 \\ 22 \\ 18 \end{array} \right. & \begin{array}{l} 2 \\ 2 \\ 4+2=6 \end{array} & \begin{array}{l} =2 \\ =2 \\ =6 \end{array} \left| \begin{array}{l} 10 : 60 :: 2 : 12 \text{ of 24 carats.} \\ 10 : 60 :: 2 : 12 \text{ of 22 carats.} \\ 10 : 60 :: 6 : 36 \text{ of 18 carats.} \end{array} \\
 & & \begin{array}{r} \hline 10 \qquad \qquad \qquad 60 \end{array}
 \end{array}$$

[5]

oz.

$$\begin{array}{rcl}
 18 \left\{ \begin{array}{l} 22 \\ 21 \\ 20 \\ 0 \end{array} \right. & \begin{array}{l} 18 \\ 18 \\ 18 \\ 4+3+2=9 \end{array} & \begin{array}{l} =18 \\ =18 \\ =18 \\ =9 \end{array} \left| \begin{array}{l} 63 : 21 :: 18 : 6 \text{ of 22 carats.} \\ 63 : 21 :: 18 : 6 \text{ of 21 do.} \\ 63 : 21 :: 18 : 6 \text{ of 20 do.} \\ 63 : 21 :: 9 : 3 \text{ of alloy.} \end{array} \\
 & & \begin{array}{r} \hline 63 \qquad \qquad \qquad 21 \end{array}
 \end{array}$$

[6]

lb. s.

$$\begin{array}{rcl}
 6 \left\{ \begin{array}{l} 4 \\ 5 \\ 8 \end{array} \right. & \begin{array}{l} 2 \\ 2 \\ 2+1=3 \end{array} & \begin{array}{l} =2 \\ =2 \\ =3 \end{array} \left| \begin{array}{l} 7 : 21 :: 2 : 6 \text{ at 4} \\ 7 : 21 :: 2 : 6 \text{ at 5} \\ 7 : 21 :: 3 : 9 \text{ at 6} \end{array} \\
 & & \begin{array}{r} \hline 7 \qquad \qquad \qquad 21 \end{array} \\
 7 \left\{ \begin{array}{l} 4 \\ 5 \\ 8 \end{array} \right. & \begin{array}{l} 1 \\ 1 \\ 3+2=5 \end{array} & \begin{array}{l} =1 \\ =1 \\ =5 \end{array} \left| \begin{array}{l} 7 : 35 :: 1 : 5 \text{ at 4} \\ 7 : 35 :: 1 : 5 \text{ at 5} \\ 7 : 35 :: 5 : 25 \text{ at 8} \end{array} \\
 & & \begin{array}{r} \hline 7 \qquad \qquad \qquad 35 \end{array}
 \end{array}$$

SINGLE POSITION.

[1] Suppose 24l.

$$\begin{array}{rcl}
 \frac{1}{2} \text{ of } 24 & = & 12 \\
 \frac{1}{3} \text{ of } 24 & = & 8 \\
 \frac{1}{4} \text{ of } 24 & = & 6
 \end{array}$$

26 Result.

$$\begin{array}{rcl}
 \text{£.} & \text{£.} & \text{£.} \\
 26 : 24 :: & 130 &
 \end{array}$$

130

720

24

£.

26)3120(120 Ans.

26

52

52

0

[2] £.  
 Suppose A paid 12  
 Then B paid  $12 + \frac{1}{3} = 16$   
 And C paid  $16 + \frac{1}{4} = 20$

£. £. £. Result 48

48 : 12 :: 36

12

— £.

48)432(9=sum A paid.

432

$9 + \frac{2}{3} = 12$ =sum B paid.

$12 + \frac{1}{2} = 15$ =sum C paid.

56 proof.

[3] Suppose 12 crowns.

Then  $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} = 13$  result.

Cr. Cr. Cr.

13 : 12 :: 65

12

— Cr.

13)780(60 Ans.

78

0

[4] £.

Suppose 10 the sum lent.

£. s.

$\frac{1}{2}$  of 10l.=2 10

$\frac{1}{3}$  of 10l.=2 00

$\frac{1}{6}$  of 10l.=1 13 4

l. s. d. 6 3 4 result.

6 3 4 : 10 :: 74

6 6 60

37 0 0 60 37)4440(120l.

37 Ans.

74

74

0

[5] Suppose 10l. in it.

l. l. s. d.

$\frac{2}{3}$  of 10=3 6 8

$\frac{1}{2}$  of 10=2 10 0

$\frac{1}{3}$  of 10=2 0 0

7 16 8 result.

l. s. d. l. l.

7 16 8 : 10 :: 94

6 6 60

47 0 0 60 47)5640(120

47 Ans.

94

94

0

[6]

£.

Suppose

50

6

300

10

30,00

50

80 Result.

l. l. l.

8,0 : 5,0 :: 500

5

8)2500

£.312 10s. Ans.

DOUBLE POSITION.

[1]

Suppose A had 5  
Then B had  $5+3=8$   
and C had  $8+4=12$

25  
100

Error too little 75

Suppose A had 10  
Then B had  $10+3=13$   
and C had  $13+4=17$

40  
100

Error too little 60

<i>Pos.</i>	<i>Er.</i>
5	75
10	60

75	750	300
60	300	
15	450	

30 = A's share.

$30+3=33$  = B's share.

$33+4=37$  = C's share.

100 Proof.

[2]

Suppose the 1st had 50  
Then the 2d had  $100-8=92$   
and the 3d had  $150-15=135$

277  
100

Error too great 177

Suppose the 1st had 30  
Then the 2d had  $60-8=52$   
and the 3d had  $90-15=75$

157  
100

Error too great 57

<i>Pos.</i>	<i>Er.</i>
50	177
30	57

177	5310	2850
57	2850	

12,0	246,0	share.
------	-------	--------

£.	s.	£	20	10	= 1st
20	10	$\times 2$	8	= 33	00
20	10	$\times 3$	15	= 46	10

100 00 proof

[3]

Suppose A paid 25  
Then B paid  $25+10=35$   
and C paid  $25+35=60$

120  
100

Error too great 20

Suppose A paid 15  
Then B paid  $15+10=25$   
and C paid  $15+25=40$

80  
100

Error too little 20

<i>Pos.</i>	<i>Er.</i>
25	20
15	20
<hr/>	
20   300	500
20   500	
<hr/>	
4,0   80,0	
<hr/>	
20 = sum A paid.	
20 + 10 = 30 = sum B paid.	
20 + 30 = 50 = sum C paid.	
<hr/>	
100 proof.	

[4]	
Suppose C's age =	70
<hr/>	
Then B's = $70\frac{0}{2} + 20 =$	55
and A's =	20
<hr/>	
	75
	70
<hr/>	
Error too great 5	
Suppose C's age =	60
<hr/>	
Then B's = $60\frac{0}{2} + 20 =$	50
and A's =	20
<hr/>	
	70
	60
<hr/>	

Error too great 10	
<i>Pos.</i>	<i>Er.</i>
70	5
60	10
<hr/>	
300	10   700
	5   300
<hr/>	
	5   400
<hr/>	
80 = C's age	

$$\begin{aligned} 80\frac{0}{2} + 20 &= 60 = \text{B's} \\ 20 &= \text{A's} \\ \hline \text{Proof } 80 &= \text{A's \& B's} \end{aligned}$$

$$\begin{aligned} &[5] \\ \text{Suppose the estate} &= 600 \end{aligned}$$

$$\begin{aligned} \text{Then F's share } 600\frac{0}{3} - 50 &= 250 \\ \text{G's do. } 600\frac{0}{3} &= 200 \end{aligned}$$

$$\begin{aligned} \text{H's do.} &= 150 \\ \text{G's} - \text{H's} &= 50 \\ \text{Should be} &= 10 \end{aligned}$$

$$\begin{aligned} &\text{Error too great } 40 \\ \text{Suppose the estate} &= 900 \end{aligned}$$

$$\begin{aligned} \text{Then F's share } 900\frac{0}{3} - 50 &= 400 \\ \text{G's do. } 900\frac{0}{3} &= 300 \end{aligned}$$

$$\begin{aligned} \text{H's do.} &= 200 \\ \text{G's} - \text{H's} &= 100 \\ \text{Should be} &= 10 \end{aligned}$$

$$\text{Error too great } 90$$

<i>Pos.</i>	<i>Er.</i>
600	40
900	90
<hr/>	
36000	90   54000
	40   36000
<hr/>	
	5,0   1800,0
<hr/>	

$$\text{\$ } 360 = \text{est.}$$



£. 360 = est.

[7] Suppose the eldest 25  
Then  $5+4+2=$  11

F's sh. =  $360 \frac{0}{2} - 50 = 180$

G's =  $360 \frac{0}{3} =$  120

The youngest 14  
2

250

H's = 110

28

25

[6] Suppose 20 hogs.

Then 20 hogs at 18 = 360  
20 sows at 16 = 320  
60 pigs at 2 = 120

Error too great 3  
Suppose the eldest 15  
Then  $5+4+2=$  11

800

50% = 1000

4

2

8

15

Error too little 200

Suppose 30 hogs.

Then 30 hogs at 18 = 540  
30 sows at 16 = 480  
90 pigs at 2 = 180

Error too little 7

1200

50% = 1000

Pos. Er.  
25 3  
15 7

45 3 | 175

7 | 45

10 | 220

Error too great 200

Pos. Er.

20 200

30 200

200 6000 4000

200 4000

4,00 100,00

22 the 1st  
 $22-5=17$  the 2nd  
 $17-4-2=11$  the 3d & 4th  
2

Proof 22 = the 1st.

25 hogs at 18 = 450

25 sows at 16 = 400

75 pigs at 2 = 150

2,0)100,0

Proof £. 50

## ARITHMETICAL PROGRESSION.

Case 1.

$$\begin{array}{r} \overline{1+12 \times 12} \quad \overline{13 \times 12} \quad \overline{78} \\ \hline 2 \qquad \qquad 2 \qquad \qquad 1 \\ \hline \end{array} = 78 \text{ Ans.} \quad [1]$$

$$\begin{array}{r} \overline{1+100 \times 100} \quad \overline{101 \times 100} \\ \hline 2 \qquad \qquad 2 \\ \hline \end{array} = 5050s. = £.252 \text{ } 10s. \text{ Ans.} \quad [2]$$

When one extreme, the common difference, and number of terms are given; to find the other extreme: Multiply the common difference by 1 less than the number of terms; then add the product to the least term, and the sum will be the greatest, or subtract it from the greatest term, to give the least.

$$2 \times 19 - 1 + 1 = 2 \times 18 + 1 = 36 + 1 = 37 \text{ the greatest term.} \quad [3]$$

$$\begin{array}{r} \overline{1+37 \times 19} \quad \overline{38 \times 19} \quad \overline{361} \\ \hline 2 \qquad \qquad 2 \qquad \qquad 1 \\ \hline \end{array} = 361d. = £.1 \text{ } 10s. \text{ } 1d. \text{ Ans.}$$

$$3 \times 20 - 1 + 3 = 3 \times 19 + 3 = 57 + 3 = 60 \text{ the greatest term.} \quad [4]$$

$$\begin{array}{r} \overline{3+60 \times 20} \quad \overline{63 \times 20} \quad \overline{630} \\ \hline 2 \qquad \qquad 2 \qquad \qquad 1 \\ \hline \end{array} = 630d. = 2l. \text{ } 12s. \text{ } 6d. \text{ Ans.}$$

$$\begin{array}{r} \overline{1+100 \times 100} \quad \overline{101 \times 100} \\ \hline 2 \qquad \qquad 2 \\ \hline \end{array} = 5050 \text{ Cr.} = 1262l. \text{ } 10s. \text{ Ans.} \quad [5]$$

[6]

From the basket to the first stone and back again, the distance is 4 yds. and from the basket to the 2d stone and back again is 8 yards; therefore 4 is the first term, and  $8 - 4 = 4$  the common difference; whence,



$$36-3 \quad 33$$

[3]

-----=3 the common difference.

$$12-1 \quad 11$$

Therefore 3, 6, 9, 12, &c. are the respective days' journeys;

$$\text{and } \frac{3+36 \times 12}{2} = \frac{39 \times 12}{2} = 39 \times 6 = 234 \text{ miles the whole dist.}$$

$$40-4 \quad 36$$

[4]

-----=4 the common difference; and 4, 8, 12, 16, 20,

$$10-1 \quad 9$$

&c. the respective days' journeys. Also,

$$\frac{4+40 \times 10}{2} = \frac{44 \times 10}{2} = 44 \times 5 = 220 \text{ miles, the whole journey.}$$

## GEOMETRICAL PROGRESSION.

The following is considered preferable to Dilworth's rule.

Raise the ratio to the power denoted by the number of terms, subtract 1, and multiply the remainder by the 1st term: the product divided by the ratio, less 1, gives the sum of the progression. Or thus, let  $a$  = the first term,  $r$  = the ratio,  $n$  = the number of terms, and

$$s = \text{the sum of the series : then } s = \frac{r^n - 1}{r - 1} \times a.$$

[1]

$$\text{Here } s = \frac{r^n - 1}{r - 1} \times a = \frac{2^{32} - 1}{2 - 1} \times 1 = \frac{2^{32} - 1}{1} \times 1 = 2^{32} - 1. \text{ That is,}$$

$$2^1, 2^2, 2^3, 2^4, 2^5, 2^6, 2^7, 2^8 = 8\text{th power.}$$

$$256 = 8\text{th power.}$$

$$\text{-----}$$

$$1536$$

$$1280$$

$$512$$

$$\text{-----}$$

$$65536 = 16\text{th power.}$$

65536 = 16th power.

65536 = 16th do.

393216  
196608  
327680  
327680  
393216

4294967296 = 32nd do.

1  
4)4294967295  
12)1073741823 $\frac{3}{4}$   
2,0)8947848,5  $3\frac{3}{4}$   
£. 4473924 5  $3\frac{3}{4}$  Ans.

[2]  $s = \frac{r^n - 1}{r - 1} \times a = \frac{2^{15} - 1}{2 - 1} \times 1 = \frac{2^{15} - 1}{1} \times 1 = 2^{15} - 1$ . That is

$2^1, 2^2, 2^3, 2^4, 2^5, 2^6, 2^7, 2^8 = 8\text{th power.}$   
 $128 = 7\text{th do.}$

2048  
512  
256  
32768 = 15th power.  
1  
2,0)3276,7  
16381. 7s. Ans.

[3]  $s = \frac{r^n - 1}{r - 1} \times a = \frac{3^{20} - 1}{3 - 1} \times 3 = \frac{3^{20} - 1}{2} \times 3$ . That is

$3, 9, 27, 81, 243, 729, 2187, 6561, 19683, 59049 = 10\text{th power.}$   
 $59049 = 10 \text{ do.}$

---

531441

236196

531441

295245

---

3486784401 = 20th power.

1

---

3486784400

3

---

2) 10460353200

---

12) 5230176600

---

2,0) 43584805,0

---

21792402. 10s. Ans.

[4]

$\frac{n}{r-1} \quad \frac{12}{4-1} \quad \frac{12}{4-1}$

Here  $s = \frac{n}{r-1} \times a = \frac{12}{4-1} \times 1 = \frac{12}{3}$ . That is

$4, 16, 64, 256, 1024, 4096 = 6\text{th power.}$   
 $4096 = 6\text{th do.}$

---

24576

36864

16384

---

16777216

1

---

3) 16777215.

---

4) 5592405

---

12) 1398101  $\frac{1}{4}$

---

2,0) 11650,8  $5\frac{1}{2}$

$$2,0)11650,8 \ 5\frac{1}{4}$$

$$\underline{\pounds.5825 \ 8 \ 5\frac{1}{4} \text{ sold for.}}$$

$$12 \text{ oz. at } \pounds.4 = \underline{\pounds.48 \ 0 \ 0 \text{ bought for.}}$$

$$\text{Ans. } \pounds.5777 \ 8 \ 5\frac{1}{4} \text{ gained.}$$

[5]

It is evident that this question is erroneously stated. 'The worth of the whole produce' is meant for the servant's wages; which is not true; inasmuch as the crop of every year, except the last, was sowed; and consequently must not be reckoned. The sum of 'the whole produce,' exclusive of the grain first sowed, will be the sum of the Geometrical series of which  $a=10$ ,  $r=10$ , and  $n=12$ . But the servant's wages will be the *last term* of the same series;

$n-1$

which is  $ar$ .

For the solution, according to Dilworth.

$$s = \frac{a^n - 1}{r - 1} \times a = \frac{10^{12} - 1}{10 - 1} \times 10 = \frac{10^{12} - 1}{9} \times 10 : \text{ and}$$

$$10^{12} = \frac{1000000000000}{1}$$

$$\underline{999999999999}$$

$$10$$

$$\underline{9)9999999999990}$$

$$7680 \times 64 = 491520)1111111111110(2260561$$

$$\underline{983040}$$

$$4$$

$$\underline{1280711}$$

$$2,0)904224,4$$

$$\underline{983040}$$

$$\pounds.452112 \ 4s. \text{ Ans.}$$

$$\underline{2976711}$$

$$\underline{2949120}$$

$$2759111$$

2759111  
2457600

3015111  
2949120

659910  
491520

168390

Note.  $\frac{r^n}{r-1} \times a \mp 1$  is what the farmer gives for the servant's wages; but  $ar^{n-1}$ , only, is received by the servant. The rest being sowed.

For the true answer, or servant's wages

$ar = 10 \times 10 = 100$ ; and  
 $7680 \times 64 = 491520$

1000000000000  
2034505  
983040  
1696000 2,0)813802,0  
1474560  
2214400  
1966080  
2483200  
2457600  
2560000  
2457600  
102400

[6]

Here:  $\frac{r^n}{r-1} \times a = \frac{3^{20}}{3-1} \times 4 = \frac{3^{20}}{2} \times 4 = (3^{20}) \times 2$ . That is



$3^1, 3^2, 3^3, 3^4, 3^5, 3^6, 3^7, 3^8, 3^9, 3^{10} = 10\text{th pow.}$   
 $59049 = 10\text{th pow.}$

---

531441  
 236196  
 531441  
 295245

---

3486784401 = 30th pow.  
 1

---

3486784400  
 2

---

$7680 \times 64 = 491520$  8 s. d.  
 6973568800 (14187 at 2 6  
 491520

---

6. 1773 7 6  
 2058368 (Ans.  
 1966080

---

922888  
 491520

---

4313680  
 3932160

---

3815200  
 3440640

---

374560

---

[7]

Here  $s = \frac{r^n - 1}{r - 1} \times a = \frac{3^0 - 1}{3 - 1} \times 2 = \frac{3^{30} - 1}{3 - 1} \times 2 = 3^{30} - 1$ . That is

$3^1, 9^2, 27^3, 81^4, 243^5, 729^6, 2187^7, 6561^8 = 8\text{th power.}$   
 $2187 = 7\text{th power.}$

---

45927  
 52488  
 6561  
 13122

---

14348907 = 15th do.  
 14348907 = 15th do.

---

100442349  
 129140163  
 114791256  
 57395628  
 43046721  
 57395628  
 14348907

---

205891132094649 = 30th do.  
 1

---

1,00)2058911320946,48

---

4)2058911320946

---

12)514727830236 $\frac{1}{2}$

---

2,0)4289398585,3 0 $\frac{1}{2}$

---

£. 2144699292 13 0 $\frac{1}{2}$  the velvet produced.  
 30 yds. at £ 50 = 1500 0 0

---

£. 2144697792 13 0 $\frac{1}{2}$  gain.

## PERMUTATION.

[1]

$$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times 12 = 479001600 \text{ changes}$$

*d. h.*

365 6

24

1466

730

8766

60

525960

4)479001600

6)119750400

*Y. W. D.*)19958400(37 49  $2\frac{1}{2}$  Ans.

1577880

4179600

3681720

6,0)49788,0

6)24)8298

4)1383

7)345 $\frac{1}{2}$ *w. 49  $2\frac{1}{2}$  days.*

[2]

$$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 = 40320 \text{ positions.}$$

*da. h.*

365 6

4

40320

4

1461 0

*hrs. da.*161280(110 142 $\frac{1}{2}$  Ans.

1461

1518

1461

4)570

142 $\frac{1}{2}$

# A KEY TO DILWORTH'S ARITHMETIC.

## PART II.

### REDUCTION OF VULGAR FRACTIONS.

#### Case 1.

$$[1] \quad \frac{3}{6} \& \frac{5}{8} = \frac{3 \times 8}{6 \times 8} \& \frac{5 \times 6}{8 \times 6} = \frac{24}{48} \& \frac{30}{48} \quad \text{Ans.}$$

$$[2] \quad \frac{7}{8}, \frac{9}{10} \& \frac{11}{12} = \frac{7 \times 10 \times 12}{8 \times 10 \times 12}, \frac{9 \times 8 \times 12}{10 \times 8 \times 12} \& \frac{11 \times 8 \times 10}{12 \times 8 \times 10} = \frac{840}{960}, \frac{864}{960} \& \frac{880}{960} \quad \text{Ans.}$$

$$[3] \quad \frac{6}{10}, \frac{4}{8}, \frac{1}{9} \& \frac{6}{7} = \frac{6 \times 8 \times 9 \times 7}{10 \times 8 \times 9 \times 7}, \frac{4 \times 10 \times 9 \times 7}{8 \times 10 \times 9 \times 7}, \frac{1 \times 10 \times 8 \times 7}{9 \times 10 \times 8 \times 7} = \frac{3024}{5040}, \frac{2520}{5040}, \frac{560}{5040} \& \frac{4320}{5040} \quad \text{Ans.}$$

$$[4] \quad \frac{4}{9}, \frac{7}{11}, \frac{6}{7} \& \frac{1}{2} = \frac{4 \times 11 \times 7 \times 2}{9 \times 11 \times 7 \times 2}, \frac{7 \times 9 \times 7 \times 2}{11 \times 9 \times 7 \times 2}, \frac{6 \times 9 \times 11 \times 2}{7 \times 9 \times 11 \times 2} = \frac{616}{1386}, \frac{882}{1386}, \frac{1188}{1386} \& \frac{693}{1386} \quad \text{Ans.}$$

$$[5] \quad \frac{6}{9}, \frac{2}{7}, \frac{1}{3} \& \frac{7}{8} = \frac{6 \times 7 \times 3 \times 8}{9 \times 7 \times 3 \times 8}, \frac{2 \times 9 \times 3 \times 8}{7 \times 9 \times 3 \times 8}, \frac{1 \times 9 \times 7 \times 8}{3 \times 9 \times 7 \times 8} = \frac{1008}{1512}, \frac{432}{1512}, \frac{504}{1512} \& \frac{1323}{1512} \quad \text{Ans.}$$

$$[6] \quad \frac{4}{5}, \frac{1}{2}, \frac{5}{6} \& \frac{2}{8} = \frac{4 \times 2 \times 6 \times 8}{5 \times 2 \times 6 \times 8}, \frac{1 \times 5 \times 6 \times 8}{2 \times 5 \times 6 \times 8}, \frac{5 \times 5 \times 2 \times 8}{6 \times 5 \times 2 \times 8} = \frac{384}{480}, \frac{240}{480}, \frac{400}{480} \& \frac{120}{480} \quad \text{Ans.}$$

## Case 2.

$$\begin{array}{r} 48 \overline{) 56(1} \\ 48 \\ \hline \end{array}$$

[1]

$$\begin{array}{r} 60 \overline{) 125(2} \\ 120 \\ \hline \end{array}$$

[4]

$$\begin{array}{r} * G.C.M. 8 \overline{) 48(6} \\ 48 \\ \hline \end{array}$$

$$\begin{array}{r} G.C.M. 5 \overline{) 60(12} \\ 60 \\ \hline \end{array}$$

$$8 \overline{) \frac{48}{8}(\frac{6}{1} \text{ Ans.}}$$

$$5 \overline{) \frac{60}{5}(\frac{12}{1} \text{ Ans.}}$$

$$\begin{array}{r} 72 \overline{) 94(1} \\ 72 \\ \hline \end{array} \quad [2]$$

$$\begin{array}{r} 182 \overline{) 196(1} \\ 182 \\ \hline \end{array} \quad [5]$$

$$2 \overline{) \frac{72}{2}(\frac{36}{1} \text{ Ans.}}$$

$$\begin{array}{r} G.C.M. 14 \overline{) 182(13} \\ 14 \\ \hline \end{array}$$

$$\begin{array}{r} 22 \overline{) 72(3} \\ 66 \\ \hline \end{array}$$

$$\begin{array}{r} 42 \\ 42 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \overline{) 22(3} \\ 18 \\ \hline \end{array}$$

$$14 \overline{) \frac{182}{14}(\frac{13}{1} \text{ Ans.}}$$

$$\begin{array}{r} 4 \overline{) 6(1} \\ 4 \\ \hline \end{array}$$

$$\begin{array}{r} 468 \overline{) 1184(2} \\ 936 \\ \hline \end{array} \quad [6]$$

$$\begin{array}{r} G.C.M. 2 \overline{) 4(2} \\ 4 \\ \hline \end{array}$$

$$\begin{array}{r} 248 \overline{) 468(1} \\ 248 \\ \hline 220 \overline{) 248(1} \\ 220 \\ \hline \end{array}$$

$$\begin{array}{r} 84 \overline{) 170(2} \\ 168 \\ \hline \end{array} \quad [3]$$

$$\begin{array}{r} 28 \overline{) 220(7} \\ 196 \\ \hline \end{array}$$

$$\begin{array}{r} G.C.M. 2 \overline{) 84(42} \\ 84 \\ \hline \end{array}$$

$$\begin{array}{r} 24 \overline{) 28(1} \\ 24 \\ \hline \end{array}$$

$$2 \overline{) \frac{84}{2}(\frac{42}{1} \text{ Ans.}}$$

$$4 \overline{) \frac{468}{4}(\frac{117}{1} \text{ Ans.}}$$

$$\begin{array}{r} G.C.M. 4 \overline{) 24(6} \\ 24 \\ \hline \end{array}$$

\* G. C. M. Greatest common measure.

## Case 3.

$$[1] \quad 12 \frac{15}{17} = \frac{12 \times 17 + 15}{17} = \frac{204 + 15}{17} = \frac{219}{17} \text{ Ans.}$$

$$[2] \quad 19 \frac{12}{18} = \frac{19 \times 18 + 12}{18} = \frac{342 + 12}{18} = \frac{354}{18} \text{ Ans.}$$

$$[3] \quad 16 \frac{18}{100} = \frac{16 \times 100 + 18}{100} = \frac{1600 + 18}{100} = \frac{1618}{100} \text{ Ans.}$$

$$[4] \quad 12\frac{19}{56} = \frac{12 \times 56 + 19}{56} = \frac{672 + 19}{56} = \frac{691}{56}. \text{ Ans.}$$

$$[5] \quad 100\frac{19}{59} = \frac{100 \times 59 + 19}{59} = \frac{5900 + 19}{59} = \frac{5919}{59}. \text{ Ans.}$$

$$[6] \quad 79\frac{12}{19} = \frac{1501 + 12}{19} = \frac{1513}{19}. \text{ Ans.}$$

Case 4.

$$[1]^* \quad \begin{array}{r} 17 \overline{) 219} \\ 17 \phantom{00} \\ \hline 49 \\ 34 \phantom{00} \\ \hline 15 \end{array}$$

$$[2] \quad \begin{array}{r} 17 \overline{) 141} \\ 136 \phantom{00} \\ \hline 5 \end{array}$$

$$[3] \quad \begin{array}{r} 48 \overline{) 126} \\ 96 \phantom{00} \\ \hline 30 \end{array}$$

$$[4] \quad \begin{array}{r} 17 \overline{) 961} \\ 85 \phantom{00} \\ \hline 111 \\ 102 \phantom{00} \\ \hline 9 \end{array}$$

$$[5] \quad \begin{array}{r} 7 \overline{) 13} \\ 7 \phantom{00} \\ \hline 6 \end{array}$$

$$[6] \quad \begin{array}{r} 7 \overline{) 24} \\ 21 \phantom{00} \\ \hline 3 \end{array}$$

\* Or thus:  $\frac{219}{17} = 219 \div 17 = 12\frac{15}{17}. \text{ Ans.}$

Case 5.†

$$[1] \quad \frac{1}{2} \text{ of } \frac{2}{3} \text{ of } \frac{3}{4} = \frac{1 \times 2 \times 3}{2 \times 3 \times 4} = \frac{6}{24}. \text{ Ans.}$$

$$[2] \quad \frac{7}{8} \text{ of } \frac{4}{6} \text{ of } \frac{9}{10} = \frac{7 \times 4 \times 9}{8 \times 6 \times 10} = \frac{252}{480}. \text{ Ans.}$$

† In this case the figures should be cancelled: thus,

$$[1] \quad \frac{1}{2} \text{ of } \frac{2}{3} \text{ of } \frac{3}{4} = \frac{1^1 \times 2^1 \times 3}{2 \times 3 \times 4} = \frac{1 \times 1 \times 1}{1 \times 1 \times 4} = \frac{1}{4}. \text{ Ans.}$$

$$[3] \quad \frac{12}{14} \text{ of } \frac{5}{6} \text{ of } \frac{1}{2} = \frac{12 \times 5 \times 1}{14 \times 6 \times 2} = \frac{60}{168} \text{ Ans.}$$

$$[4] \quad \frac{5}{9} \text{ of } \frac{4}{8} \text{ of } \frac{3}{4} = \frac{5 \times 4 \times 3}{9 \times 8 \times 4} = \frac{60}{288} \text{ Ans.}$$

$$[5] \quad \frac{2}{3} \text{ of } \frac{3}{4} \text{ of } \frac{4}{5} = \frac{2 \times 3 \times 4}{3 \times 4 \times 5} = \frac{24}{60} \text{ Ans.}$$

$$[6] \quad \frac{1}{2} \text{ of } \frac{8}{9} \text{ of } \frac{6}{7} = \frac{1 \times 8 \times 6}{2 \times 9 \times 7} = \frac{48}{126} \text{ Ans.}$$

Case 6.

NOTE. Multiplying the denominator is dividing the fraction.

$$[1] \quad \frac{5}{6} d. = \frac{5}{6 \times 12 \times 20} l. = \frac{5}{1440} l. \text{ Ans.}$$

$$[2] \quad \frac{1}{2} gr. = \frac{1}{2 \times 4 \times 12} s. = \frac{1}{96} s. \text{ Ans.}$$

$$[3] \quad \frac{8}{9} oz. = \frac{8}{9 \times 12} lb. = \frac{8}{108} lb. \text{ Ans.}$$

$$[4] \quad \frac{6}{7} lb. = \frac{6}{7 \times 112} Cwt. = \frac{6}{784} Cwt. \text{ Ans.}$$

$$[5] \quad \frac{9}{13} pt. = \frac{9}{13 \times 8 \times 63} Hhd. = \frac{9}{6552} Hhd. \text{ Ans.}$$

Case 7.

NOTE. Multiplying the numerator is multiplying the fraction.

$$[1] \quad \frac{5 \times 20 \times 12}{1440} l. = \frac{1200}{1440} d. = \frac{120}{144} d. = \frac{10}{12} d. = \frac{5}{6} d. \text{ Ans.}$$

$$[2] \quad \frac{1}{96} s. = \frac{1 \times 12 \times 4}{96} grs. = \frac{48}{96} grs. = \frac{1}{2} gr. \quad \text{Ans.}$$


---

$$[3] \quad \frac{8}{108} lb. = \frac{8 \times 12^1}{108} oz. = \frac{8}{9} oz. \quad \text{Ans.}$$


---

$$[4] \quad \frac{6}{784} C. = \frac{6 \times 4 \times 28^1}{784} lb. = \frac{6}{7} lb. \quad \text{Ans.}$$


---

$$[5] \quad \frac{9}{6552} Hhd. = \frac{9 \times 63 \times 8^1}{6552} pt. = \frac{9}{112} pt. \quad \text{Ans.}$$


---

Case 8.

[1]	[2]	[3]	[4]
3 : 4 :: 15	7 : 8 :: 42	3 : 4 :: 34	5 : 9 :: 73
4	8	4	9
—	—	—	—
3)60	7)336	3)136	5)657
—	—	—	—
20	48	45 $\frac{1}{3}$	131 $\frac{2}{5}$
$\frac{3}{4} = \frac{15}{20}$ Ans.	$\frac{7}{8} = \frac{42}{48}$ Ans.	$\frac{3}{4} = \frac{34}{45\frac{1}{3}}$ Ans.	$\frac{5}{9} = \frac{73}{131\frac{2}{5}}$ Ans.

---

Case 9.

[1]	[2]	[3]	[4]
4 : 3 :: 20	8 : 7 :: 49	4 : 3 :: 46	9 : 5 :: 131 $\frac{2}{5}$
3	7	3	5
—	—	—	—
4)60	8)343	4)138	9)657
—	—	—	—
15	42 $\frac{7}{8}$	34 $\frac{2}{3}$	73
$\frac{4}{3} = \frac{16}{12}$ Ans.	$\frac{8}{7} = \frac{42\frac{7}{8}}{49}$ Ans.	$\frac{4}{3} = \frac{34\frac{2}{3}}{46}$ Ans.	$\frac{9}{5} = \frac{73}{131\frac{2}{5}}$ Ans.



## Case 10.—1st part.

$$[1] \quad \frac{42\frac{1}{2}}{49} = \frac{42 \times 8 + 7}{49 \times 8} = \frac{\overset{7}{343}}{392} = \frac{\overset{7}{49}}{56} = \frac{7}{8}^* \text{ Ans.}$$


---

$$[2] \quad \frac{34\frac{1}{2}}{46} = \frac{34 \times 2 + 1}{46 \times 2} = \frac{\overset{23^*}{69}}{92} = \frac{3}{4} \text{ Ans.}$$


---

$$[3] \quad \frac{17\frac{4}{9}}{43} = \frac{17 \times 9 + 4}{43 \times 9} = \frac{157}{387} \text{ Ans.}$$


---

## Case 10.—2d part.

$$[1] \quad \frac{73}{131\frac{2}{5}} = \frac{73 \times 5}{131 \times 5 + 2} = \frac{\overset{73}{365}}{657} = \frac{5}{9} \text{ Ans.}$$


---

$$[2] \quad \frac{41}{73\frac{1}{2}} = \frac{41 \times 4}{73 \times 4 + 1} = \frac{164}{293} \text{ Ans.}$$


---

$$[3] \quad \frac{7}{19\frac{3}{5}} = \frac{7 \times 5}{19 \times 5 + 3} = \frac{\overset{7}{35}}{98} = \frac{5}{74} \text{ Ans.}$$


---

## Case 11.

$$[1] \quad \frac{2}{3}l. = \frac{2 \times 20}{3} s. = \frac{40}{3} s. = 13s. 4d. \text{ Ans.}$$


---

$$[2] \quad \frac{18}{43}s. = \frac{18 \times 12}{43} d. = \frac{216}{43} d. = 5\frac{1}{43}d. \text{ Ans.}$$


---

$$[3] \quad \frac{6}{7} \text{ of } 5l. 9s. = \frac{6}{7} \text{ of } 109s. = \frac{\overset{3}{6 \times 109}}{7 \times 20} l. = \frac{327}{70} l. = 4\frac{47}{70} l. = 4l. 13s. 5\frac{1}{2}d. \text{ Ans.}$$

\* For reducing the fractions to their lowest terms, the reader is referred to Case 2.

$$[4] \quad \frac{12}{16} \text{ lb.} = \frac{\overset{3}{12} \times \overset{3}{12}}{16} \text{ oz.} = \frac{9}{16} \text{ oz.} = 9 \text{ oz.} \quad \text{Ans.}$$


---

$$[5] \quad \frac{12}{78} \text{ Ton} = \frac{\overset{2}{12} \times 20}{78} \text{ C.} = \frac{40}{13} \text{ C.} = 3 \text{ C. } 6 \text{ qr. } 8 \text{ lb. } 9 \text{ oz. } 13 \frac{7}{13} \text{ dr.} \quad \text{Ans.}$$


---

$$[6] \quad \frac{5}{9} \text{ lb.} = \frac{5 \times 16}{9} \text{ oz.} = \frac{80}{9} \text{ oz.} = 8 \frac{8}{9} \text{ oz.} = 8 \text{ oz. } 14 \frac{2}{3} \text{ dr.} \quad \text{Ans.}$$


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$$[7] \quad * \frac{9}{11} \text{ of } 10 \text{ C. } 1 \text{ qr. } 12 \text{ lb.} = \frac{9}{11} \text{ of } 1160 \text{ lb.} = \frac{9 \times 1160}{11 \times 12} \text{ C.}$$

$$= \frac{1305}{154} \text{ C.} = 8 \frac{73}{154} \text{ C.} = 8 \text{ C. } 1 \text{ qr. } 25 \text{ lb. } 1 \text{ oz. } 7 \frac{3}{11} \text{ dr.} \quad \text{Ans.}$$

Or thus

C.	qr.	lb.
10	1	12
		9

$$11 \overline{) 93024}$$

$$8 \text{ } 1 \text{ } 25 \text{ } 1 \text{ oz. } 7 \frac{3}{11} \text{ dr.} \quad \text{Ans.}$$


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$$[8] \quad \frac{4}{7} \text{ m.} = \frac{4 \times 8}{7} \text{ fur.} = \frac{32}{7} \text{ fur.} = 4 \text{ fur. } 125 \text{ yds. } 2 \text{ ft. } 1 \text{ in.} \quad \text{Ans.}$$

$$[9] \quad \frac{9}{10} \text{ y.} = \frac{9 \times 3}{10} \text{ ft.} = \frac{27}{10} \text{ ft.} = 2 \text{ ft. } 8 \text{ in. } 1 \frac{2}{10} \text{ b.c.} \quad \text{Ans.}$$


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$$[10] \quad \frac{4}{5} \text{ E.E.} = \frac{4 \times \overset{1}{5}}{5} \text{ qr.} = \frac{4}{1} \text{ qr.} = 4 \text{ qr.} = 1 \text{ yd.} \quad \text{Ans.}$$

\* The learner can take which way he please for working questions under this rule.

$$[11] \quad \frac{7}{16} a. = \frac{7 \times 4}{16} r. = \frac{7}{4} r. = 1r. 30ps. \text{ Ans.}$$


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$$[12] \quad \frac{4}{9} t. = \frac{7 \times 4}{9} hhd. = \frac{28}{9} hhd. = 1hhd. 49gal. \text{ Ans.}$$


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$$[13] \quad \frac{7}{8} B.B. = \frac{7 \times 36}{8} gal. = \frac{252}{8} gal. = 31\frac{1}{2} gal. \text{ Ans.}$$


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$$[14] \quad \frac{3}{8} ch. = \frac{3 \times 36}{8} bu. = \frac{108}{8} bu. = 13\frac{1}{2} bush. \text{ Ans.}$$


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$$[15] \quad \frac{2}{7} qr. = \frac{2 \times 8}{7} bu. = \frac{16}{7} bu. = 2bu. 1\frac{1}{7} peck. \text{ Ans.}$$


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$$[16] \quad \frac{7}{13} da. = \frac{7 \times 24}{12} ho. = \frac{168}{13} ho. = 12ho. 55min. 23\frac{1}{13} sec. \text{ Ans.}$$


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$$[17] \quad \frac{4}{5} mo. = \frac{4 \times 4}{5} we. = \frac{16}{5} w. = 3we. 1d. 9h. 36min. \text{ Ans.}$$


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$$[18] \quad \frac{7}{8} yd. = \frac{7 \times 4}{8} qr. = \frac{7}{2} qr. = 3qr. 2na. \text{ Ans.}$$


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$$[19] \quad \frac{2}{9} hhd.B. = \frac{2 \times 54}{9} gal. = \frac{108}{9} gal. = 12gal. \text{ Ans.}$$


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$$[20] \quad \frac{3}{16} b.A. = \frac{3 \times 32}{16} gal. = \frac{96}{16} gal. = 6gal. \text{ Ans.}$$

Case 12.

$$[1] \quad 13s. 4d. = 160d. = \frac{160}{1 \times 12 \times 20} s. = \frac{160}{240} s. = \frac{2}{3} s. \text{ Ans.}$$

$$[2] \quad 5\frac{1}{3}d. = \frac{5 \times 43 + 1}{43} d. = \frac{216}{43} d. = \frac{216}{43 \times 12} s. = \frac{18}{43} s. \text{ Ans.}$$

$$[3] \quad \begin{array}{r} l. \quad s. \quad d. \quad d. \\ 4 \quad 13 \quad 5\frac{1}{7} = 1121\frac{1}{7} \\ 5 \quad 9 \quad 0 = 1308 \end{array} \left. \vphantom{\begin{array}{r} l. \quad s. \quad d. \quad d. \\ 4 \quad 13 \quad 5\frac{1}{7} = 1121\frac{1}{7} \\ 5 \quad 9 \quad 0 = 1308 \end{array}} \right\} \text{ and } \frac{1121\frac{1}{7}}{1308} = \frac{1121 \times 7 + 1}{1308 \times 7} = \frac{7848}{9156} = \frac{1303}{1526} \text{ Ans.}$$

$$[4] \quad 9oz. = \frac{9}{1 \times 12} lb. = \frac{3}{4} lb. \text{ Ans.}$$

$$[5] \quad 3C. 0qr. 8lb. 9oz. 13\frac{2}{3}dr. = 88221\frac{4}{3}dr. = \frac{88221 \times 78 + 42}{78} dr. = \frac{6881280}{78} dr. = \frac{6881280}{78 \times 16 \times 16 \times 112 \times 20} T. = \frac{3440640}{6881280} T. = \frac{2}{13} T. = \frac{1}{6} T. \text{ Ans.}$$

$$[6] \quad 8oz. 14\frac{2}{3}dr. = 142\frac{2}{3}dr. = \frac{142 \times 9 + 2}{9} dr. = \frac{1280}{9} dr. = \frac{1280}{9 \times 16 \times 16} lb. = \frac{5}{8} lb. \text{ Ans.}$$

$$\begin{array}{r} \text{C. gr. lb. oz. dr.} \quad \text{dr.} \\ 8 \ 1 \ 25 \ 1 \ 7 \frac{3}{11} = 242967 \frac{3}{11} \\ \text{[7]} \quad 10 \ 1 \ 12 \ 0 \ 0 = 296960 \end{array} \left. \vphantom{\begin{array}{r} \text{C. gr. lb. oz. dr.} \quad \text{dr.} \\ 8 \ 1 \ 25 \ 1 \ 7 \frac{3}{11} = 242967 \frac{3}{11} \\ 10 \ 1 \ 12 \ 0 \ 0 = 296960 \end{array}} \right\} \text{ and } \frac{242967 \frac{3}{11}}{296960} =$$

$$\begin{array}{r} 242967 \times 11 + 3 \quad \frac{296960^3}{2672640} \\ \hline 296960 \times 11 \quad 3266560 \end{array} = \frac{\quad}{\quad} = \frac{9}{11} \text{ Ans.}$$

$$\begin{array}{r} \text{[8]} \quad 4 \text{ fur. } 125 \text{ yds. } 2 \text{ ft. } 1 \text{ in. } 2 \frac{1}{4} \text{ bc.} = 108617 \frac{1}{4} \text{ bc.} = \\ 760320 \quad \frac{190080}{760320} \\ \hline \text{--- m.} = \text{--- m.} = \frac{4}{7} \text{ m. Ans.} \\ 7 \times 3 \times 12 \times 3 \times 1760 \quad 1930560 \end{array}$$

$$\begin{array}{r} \text{[9]} \quad 2 \text{ ft. } 8 \text{ in. } 1 \frac{3}{16} \text{ bc.} = 97 \frac{3}{16} \text{ bc.} = \frac{972}{10 \times 3 \times 12 \times 3} \text{ yd.} \\ \frac{108}{972} \\ = \frac{\quad}{1080} \text{ yd.} = \frac{9}{16} \text{ yd. Ans.} \end{array}$$

$$\text{[10]} \quad 1 \text{ yd.} = 4 \text{ gr.} = \frac{4}{1 \times 5} \text{ Ell.} = \frac{4}{5} \text{ Ell. Ans.}$$

$$\text{[11]} \quad 1 \text{ r. } 30 \text{ p.} = 70 \text{ p.} = \frac{70}{1 \times 40 \times 4} \text{ a.} = \frac{70}{160} \text{ a.} = \frac{7}{16} \text{ a. Ans.}$$

$$\begin{array}{r} \text{[12]} \quad 1 \text{ hhd. } 49 \text{ gal.} = 112 \text{ gal.} = \frac{112}{1 \times 63 \times 4} \text{ Ton.} = \frac{28}{112} \text{ T.} \\ = \frac{1}{2} \text{ Ton. Ans.} \end{array}$$

$$\text{[13]} \quad 31 \frac{1}{2} \text{ gal.} = \frac{63}{2 \times 36} \text{ B.B.} = \frac{\frac{9}{63}}{72} \text{ B.B.} = \frac{1}{8} \text{ B.B. Ans.}$$

$$\text{[14]} \quad 13 \frac{1}{2} \text{ bu.} = \frac{27}{2 \times 36} \text{ ch.} = \frac{\frac{9}{27}}{72} \text{ ch.} = \frac{1}{8} \text{ ch. Ans.}$$

\* See Case 2; for the method of finding the greatest common measure, and reducing fractions to their lowest terms.

$$[15] \quad 2b. \ 1\frac{1}{7}h. = 9\frac{1}{7}h. = \frac{64}{7 \times 4 \times 8} gr. = \frac{\overset{32}{64}}{224} gr. = \frac{1}{4} gr. \quad \text{Ans.}$$

$$[16] \quad 12h. \ 55m. \ 23\frac{1}{13}sec. = 46523\frac{1}{13}sec. = \frac{46523 \times 13 + 1}{13} sec.$$

$$= \frac{604800}{13} sec. = \frac{\overset{7}{168} \overset{10080}{604800}}{13 \times 60 \times 60 \times 24} day. = 1\frac{7}{13} day. \quad \text{Ans.}$$

$$[17] \quad 3w. \ 1d. \ 9h. \ 36m. = 32256min. = \frac{32256}{1 \times 60 \times 24 \times 7 \times 4} mo.$$

$$= \frac{\overset{8064}{32256}}{40320} mo. = \frac{4}{5} mo. \quad \text{Ans.}$$

$$[18] \quad 3qr. \ 2na. = 14na. = \frac{14}{1 \times 4 \times 4} yd. = \frac{14}{16} yd. = \frac{7}{8} yd. \quad \text{Ans.}$$

$$[19] \quad 12gal. = \frac{12}{1 \times 54} hhd. = \frac{12}{54} hhd. \ B. = \frac{4}{18} hhd. = \frac{2}{9} hhd. \quad \text{Ans.}$$

$$[20] \quad 6gal. = \frac{6}{1 \times 32} bar. = \frac{6}{32} bar. = \frac{3}{16} bar. \quad \text{Ans.}$$

$$[21] \quad 13h. \ 30m. = 810m. = \frac{810}{1 \times 60 \times 24} da. = \frac{\overset{90}{810}}{1440} da. = 1\frac{5}{8} day. \quad \text{Ans.}$$

### ADDITION OF VULGAR FRACTIONS.

$$[1] \quad \frac{1}{2} + \frac{7}{8} = \frac{1 \times 8}{2 \times 8} + \frac{7 \times 2}{8 \times 2} = \frac{8}{16} + \frac{14}{16} = \frac{8+14}{16} = \frac{22}{16} = 1\frac{5}{8} \quad \text{Ans.}$$

$$\begin{aligned}
 [2] \quad & \frac{7}{10} + \frac{11}{12} + \frac{4}{9} = \frac{7 \times 12 \times 9}{10 \times 12 \times 9} + \frac{11 \times 10 \times 9}{12 \times 10 \times 9} + \frac{4 \times 10 \times 12}{9 \times 10 \times 12} \\
 & = \frac{756}{1080} + \frac{990}{1080} + \frac{480}{1080} = \frac{756+990+480}{1080} = \frac{2226}{1080} \\
 & = 2\frac{66}{180} \text{ Ans.}
 \end{aligned}$$

$$[3] \quad 19 + \frac{2}{3} \text{ of } 7\frac{1}{2} = 19 + \frac{2}{3} \text{ of } \frac{15}{2} = 19 + \frac{5}{1} = 19 + 5 = 24 \text{ Ans.}$$

$$\begin{aligned}
 [4] \quad & \frac{1}{2} \text{ of } \frac{7}{8} + \frac{2}{3} \text{ of } \frac{19}{20} = \frac{1 \times 7}{2 \times 8} + \frac{2 \times 19}{3 \times 20} = \frac{7}{16} + \frac{38}{60} \\
 & = \frac{7 \times 60}{16 \times 60} + \frac{38 \times 16}{60 \times 16} = \frac{420}{960} + \frac{608}{960} = \frac{420+608}{960} = \frac{1028}{960} \\
 & = 1\frac{68}{96} \text{ Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [5] \quad & \frac{1}{3} \text{ of } 95 + \frac{7}{8} \text{ of } 14 = \frac{1 \times 95}{3 \times 1} + \frac{7 \times 14}{8 \times 1} = \frac{95}{3} + \frac{98}{8} \\
 & = \frac{95 \times 8}{3 \times 8} + \frac{98 \times 3}{8 \times 3} = \frac{760}{24} + \frac{294}{24} = \frac{760+294}{24} = \frac{1054}{24} \\
 & = 43\frac{23}{24} \text{ Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [6] \quad & \frac{2}{3} + 17\frac{1}{2} = \frac{2}{3} + \frac{35}{2} = \frac{2 \times 2}{3 \times 2} + \frac{35 \times 3}{2 \times 3} = \frac{4}{6} + \frac{105}{6} \\
 & = \frac{4+105}{6} = \frac{109}{6} = 18\frac{1}{6} \text{ Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [7] \quad & 12\frac{1}{2} + 3\frac{1}{3} + 4\frac{3}{4} = \frac{25}{2} + \frac{11}{3} + \frac{19}{4} = \frac{25 \times 3 \times 4}{2 \times 3 \times 4} + \frac{11 \times 2 \times 4}{3 \times 2 \times 4} + \frac{19 \times 2 \times 3}{4 \times 2 \times 3} \\
 & = \frac{300}{24} + \frac{88}{24} + \frac{114}{24} = \frac{300+88+114}{24} \\
 & = \frac{502}{24} = 20\frac{13}{6} \text{ Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [8] \quad \frac{9}{10} \text{ of } 6\frac{7}{8} + \frac{4}{7} \text{ of } \frac{1}{2} + 7\frac{1}{2} &= \frac{9 \times 55}{10 \times 8} + \frac{4 \times 1}{7 \times 2} + \frac{15}{2} = \\
 \frac{495}{80} + \frac{4}{14} + \frac{15}{2} &= \frac{495 \times 14 \times 2}{80 \times 14 \times 2} + \frac{4 \times 80 \times 2}{14 \times 80 \times 2} + \frac{15 \times 80 \times 14}{2 \times 80 \times 14} \\
 &= \frac{13860}{2240} + \frac{640}{2240} + \frac{16800}{2240} = \frac{31300}{2240} = 13\frac{2180}{2240} \text{ Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [9] \quad \begin{array}{ccccccc} \text{£.} & \text{s.} & \text{s.} & \text{s.} & \text{s.} & \text{s.} & \text{s.} \\ 7 & 3 & 140 & 3 & 140 & 6 & 146 \end{array} & \begin{array}{cc} \text{s.} & \text{d.} \end{array} \\
 - + - = - + - = - + - = - &= 18 \text{ } 3. \text{ Ans.} \\
 8 & 4 \quad 8 \quad 4 \quad 8 \quad 8 \quad 8
 \end{aligned}$$

$$\begin{aligned}
 [10] \quad \begin{array}{ccccccc} \text{d.} & \text{£.} & \text{s.} & \text{s.} & \text{s.} & \text{s.} & \text{s.} \\ 3 & 1 & 3 & 1 \times 20 & 3 & 20 & 3 \times 9 \end{array} & \begin{array}{cc} \text{s.} & \text{d.} \end{array} \\
 - + - = - + - = - + - = - &= 2 \text{ } 3\frac{1}{4} + \frac{2 \times 2}{4 \times 3\frac{1}{2}} = 2 \text{ } 3\frac{1}{4} + \frac{2}{3}. \text{ Ans.} \\
 9 \times 48 & 27 \quad 987 \quad 432 \quad 432
 \end{aligned}$$

$$\begin{aligned}
 [11] \quad \begin{array}{ccccccc} \text{lb.} & \text{oz.} & \text{oz.} & \text{oz.} & \text{oz.} & \text{oz.} & \text{dwt. grs.} \\ 1 & 7 & 1 \times 12 & 7 & 7 & 6\frac{7}{12} & 6 \text{ } 11 \text{ } 16 \end{array} \\
 - + - = - + - = 6\frac{7}{12} &= 6 \text{ } 11 \text{ } 16. \text{ Ans.} \\
 2 & 12 \quad 2 \quad 12
 \end{aligned}$$

$$\begin{aligned}
 [12] \quad \begin{array}{ccccccc} \text{T.} & \text{C.} & \text{C.} & \text{C.} & \text{C.} & \text{C.} & \text{C.} \\ 4 & 9 & 4 \times 20 & 9 & 80 & 9 & 80 \times 10 \end{array} & \begin{array}{cc} \text{C.} & \text{C.} \end{array} \\
 - + - = - + - = - + - = - &= 12\frac{23}{70} = 12 \text{ } 1 \text{ } 8 \text{ } 12 \text{ } 12\frac{2}{10} \text{ Ans.} \\
 7 & 10 \quad 7 \quad 10 \quad 7 \quad 10 \quad 7 \times 10 \quad 10 \times 7 \\
 \text{G.} & \text{C.} & \text{C.} & \text{C.} & \text{C.} & \text{gr.} & \text{lb.} & \text{oz.} & \text{dr.} \\
 800 & 63 & 863 & 12\frac{23}{70} & 12 & 1 & 8 & 12 & 12\frac{2}{10} \\
 70 & 70 & 70 & & & & & &
 \end{aligned}$$

$$\begin{aligned}
 [13] \quad \begin{array}{ccccccc} \text{m.} & \text{fur.} & \text{fur.} & \text{fur.} & \text{fur.} & \text{fur.} & \text{po.} \\ 3 & 7 & 3 \times 8 & 7 & 6\frac{7}{10} & 6 & 28 \end{array} \\
 - + - = - + - = 6\frac{7}{10} &= 6 \text{ } 28 \text{ Ans.} \\
 4 & 10 \quad 4 \quad 10
 \end{aligned}$$



$$\begin{array}{cccccccccc}
 \text{yd.} & \text{ft.} & \text{ft.} & \text{ft.} & \text{ft.} & \text{ft.} & \text{ft.} & \text{ft.} & \text{ft.} & \\
 1 & 2 & 3 & 2 & 3 \times 3 & 2 \times 2 & 9 & 4 & 13 & \text{ft. in.} \\
 [14] & - & + & - & - & + & - & - & - & = 2 \ 2 \text{ Ans.} \\
 2 & 3 & 2 & 3 & 2 \times 3 & 3 \times 2 & 6 & 6 & 6 & 
 \end{array}$$

$$\begin{array}{ccccccc}
 \text{da.} & \text{hr.} & \text{hr.} & \text{hr.} & & \text{hr.} & \text{hr. min.} \\
 1 & 1 & 1 \times 24 & 1 & & & \\
 [15] & - & + & - & + & - & 8 \frac{1}{2} = 8 \ 30. \text{ Ans.} \\
 3 & 2 & 3 & 2 & & & 
 \end{array}$$

$$\begin{array}{ccccccc}
 \text{ch.} & \text{bu.} & \text{bu.} & \text{bu.} & & \text{bu.} & \text{bu. p.} \\
 4 & 7 & 4 \times 36 & 7 & & & \\
 [16] & - & + & - & + & - & = 16 \frac{7}{8} = 16 \ 3 \frac{1}{2}. \text{ Ans.} \\
 9 & 8 & 9 & 8 & & & 
 \end{array}$$

$$\begin{array}{cccccccccc}
 \text{w.} & \text{d.} & \text{h.} & \text{d.} & \text{d.} & \text{d.} & & \text{d.} & \text{d.} & \text{d.} \\
 1 & 1 & 1 & 1 \times 7 & 1 & 1 & & 7 & 1 & 1 \\
 [17] & - & + & - & + & - & + & - & + & - = \\
 3 & 4 & 2 & 3 & 4 & 2 \times 24 & 3 & 4 & 48 & 
 \end{array}$$

$$\begin{array}{ccccccc}
 \text{d.} & \text{d.} & \text{d.} & \text{d.} & \text{d.} & \text{d.} & \text{d.} \\
 7 \times 16 & 1 \times 12 & 1 & 112 & 12 & 1 & 125 \text{ d. h.} \\
 \frac{\quad}{3 \times 16} + \frac{\quad}{4 \times 12} + \frac{\quad}{48} = \frac{\quad}{48} + \frac{\quad}{48} + \frac{\quad}{48} = \frac{\quad}{48} = 2 \ 14 \frac{1}{2}. \text{ Ans.}
 \end{array}$$

$$\begin{array}{ccccccc}
 \text{yd.} & \text{ft.} & \text{m.} & \text{yd.} & \text{yd.} & & \text{yd.} & \text{yd.} & \text{yd.} & \text{yds.} \\
 2 & 3 & 7 & 2 & 3 & & 7 \times 1760 & 2 & 1 & \\
 [18] & - & + & - & + & - & + & - & + & = 1540 \\
 3 & 4 & 8 & 3 & 4 \times 3 & 8 & 3 & 4 & & 
 \end{array}$$

$$\begin{array}{ccccccc}
 \text{yd.} & \text{yd.} & \text{yds.} & \text{yds.} & \text{yds. ft. in.} & & \\
 = \frac{8}{12} + \frac{3}{12} + 1540 = 1540 \frac{11}{12} = 1540 \ 2 \ 9. \text{ Ans.}
 \end{array}$$

## SUBTRACTION OF VULGAR FRACTIONS.

$$\begin{array}{ccccccc}
 111 & 3 & 111 \times 4 & 3 \times 112 & 444 & 336 & \\
 [1] & - & - & - & - & - & = \\
 112 & 4 & 112 \times 4 & 4 \times 112 & 448 & 448 & \\
 \frac{111}{112} \text{ Ans.}
 \end{array}$$

$$\begin{array}{ccccccc}
 97 & 3 & 97 \times 7 & 3 \times 100 & 679 & 300 & \\
 [2] & - & - & - & - & - & = \\
 100 & 7 & 100 \times 7 & 7 \times 100 & 700 & 700 & \\
 \frac{97}{100} \text{ Ans.}
 \end{array}$$

$$[3] \quad 96\frac{1}{3} - 14\frac{3}{7} = \frac{289}{3} - \frac{101}{7} = \frac{289 \times 7}{3 \times 7} - \frac{101 \times 3}{7 \times 3} =$$

$$\frac{2023}{21} - \frac{303}{21} = \frac{1720}{21} = 81\frac{19}{21} \text{ Ans.}$$

$$[4] \quad 96 - \frac{2}{3} = 95\frac{2}{3} \text{ Ans.}$$

$$[5] \quad \frac{1}{3} \text{ of } \frac{76}{1} - \frac{3}{4} \text{ of } \frac{21}{1} = \frac{76}{3} - \frac{63}{4} = \frac{76 \times 4}{3 \times 4} - \frac{63 \times 3}{4 \times 3} =$$

$$\frac{304}{12} - \frac{189}{12} = \frac{115}{12} = 9\frac{7}{12} \text{ Ans.}$$

$$[6] \quad \frac{109}{110} - \frac{1}{2} \text{ of } \frac{2}{3} \text{ of } \frac{3}{4} = \frac{109}{110} - \frac{6}{24} = \frac{109 \times 24}{110 \times 24} - \frac{6 \times 110}{24 \times 110} =$$

$$\frac{2616}{2640} - \frac{660}{2640} = \frac{1956}{2640} \text{ Ans.}$$

$$[7] \quad 71\frac{1}{2} - \frac{17}{19} = \frac{143}{2} - \frac{17}{19} = \frac{143 \times 19}{2 \times 19} - \frac{17 \times 2}{19 \times 2} =$$

$$\frac{2717}{38} - \frac{34}{38} = \frac{2683}{38} = 70\frac{23}{38} \text{ Ans.}$$

$$[8] \quad 14\frac{1}{4} - \frac{2}{3} \text{ of } 19 = \frac{57}{4} - \frac{38}{3} = \frac{57 \times 3}{4 \times 3} - \frac{38 \times 4}{3 \times 4} =$$

$$\frac{171}{12} - \frac{152}{12} = \frac{19}{12} = 1\frac{7}{12} \text{ Ans.}$$

$$[9] \quad \begin{array}{ccccccc} \text{£.} & \text{s.} & & \text{s.} & & \text{s.} & \text{s.} & \text{s.} & \text{d.} \\ 1 & 3 & 1 \times 20 & 3 & & & & & \\ \hline 2 & 4 & 2 & 4 & & 10 & - \frac{3}{4} & = 9\frac{1}{4} & = 9 \text{ } 3 \text{ Ans.} \end{array}$$

$$[10] \quad \frac{s.}{\frac{1}{2}} - \frac{d.}{\frac{3}{4}} = 6 - \frac{d.}{\frac{3}{4}} = 5\frac{1}{4} \text{ Ans.}$$

$$\begin{array}{ccccccc}
 \text{oz.} & \text{dwt.} & \text{dwt.} & \text{dwt.} & \text{dwt.} & \text{dwt.} & \text{dwt. gr.} \\
 3 & 7 & 3 \times 20 & 7 & \text{dwt.} & 7 & \text{dwt.} \\
 - & - & - & - & = 12 & - & = 11\frac{1}{2} = 11\ 3 \\
 5 & 8 & 5 & 8 & & 8 & \text{Ans:}
 \end{array}$$

[12]      C.    lb.      lb.      lb.      lb.      gr. lb. oz. dr.  
 $\frac{1}{2} - \frac{7}{12} = 56 - \frac{7}{12} = 55\frac{5}{12} = 1\ 27\ 6\ 10\frac{5}{12}$  Ans.

[13]  $\frac{\begin{smallmatrix} lc. \\ 2 \end{smallmatrix}}{\begin{smallmatrix} m. \\ 3 \end{smallmatrix}} = \frac{\begin{smallmatrix} m. \\ 2 \times 3 \end{smallmatrix}}{\begin{smallmatrix} m. \\ 3 \end{smallmatrix}} = \frac{\begin{smallmatrix} m. \\ 7 \end{smallmatrix}}{\begin{smallmatrix} m. \\ 10 \end{smallmatrix}} = 2 - \frac{\begin{smallmatrix} m. \\ 7 \end{smallmatrix}}{\begin{smallmatrix} m. \\ 16 \end{smallmatrix}} = 1\frac{3}{16} = 1\frac{2}{8} = 1\frac{1}{4}$  Ans.

[14]  $\begin{array}{ccccccc} \text{Ell.} & \text{qr.} & & \text{qr.} & \text{qr.} & \text{y. qr. na.} \\ 1 - \frac{7}{10} & = & 5 - \frac{7}{10} & = & 4\frac{3}{10} & = & 1\ 0\ 1\frac{3}{10} \text{ Ans.} \end{array}$

$$[15] \quad \begin{array}{ccccccc} \text{hhd.} & & \text{gal.} & & \text{gal.} & & \text{gal.} \\ 3 & \text{gal.} & 3 \times 54 & \text{gal.} & 162 & \text{gal.} & \text{gal.} \\ \hline 12 & & 12 & & 12 & & 12 \end{array} \quad \begin{array}{l} - 1 = \\ - 1 = \\ - 1 = \\ - 1 = \end{array} \quad \begin{array}{l} 13\frac{6}{12} \\ 13\frac{6}{12} \\ 13\frac{6}{12} \\ 13\frac{6}{12} \end{array} \quad \begin{array}{l} - 1 = \\ - 1 = \\ - 1 = \\ - 1 = \end{array}$$

$12\frac{1}{2}$  gals. Ans.

[16] 
$$\begin{array}{ccccccc} ch. & bu. & bu. & & bu. & & bu. \\ 4 & 2 & 4 \times 36 & 2 & bu. & 2 & bu. \\ \hline & & & & & & bu. \\ 8 & 3 & 8 & 3 & & 3 & 17\frac{1}{2} = 17\frac{1}{2} \end{array}$$
 Ans.

[17]  $\begin{array}{cccccc} w. & d. & d. & d. & d. & w. d. h. m. \\ 7 - 9\frac{7}{10} = & 49 - 9\frac{7}{10} = & 39\frac{3}{10} = & 5 & 4 & 7 & 12 \text{ Ans.} \end{array}$

$$[18] \quad \begin{array}{ccccccc} d. h. & d. h. & h. & h. & h. & h. \\ 4 \ 7\frac{1}{2} & - \ 1 \ 9\frac{3}{16} & = & 103\frac{1}{2} & - \ 33\frac{3}{16} & = & 103\frac{1}{2} & - \ 33\frac{3}{16} \\ & & & h. & d. h. & & \\ & & & = 70\frac{8}{16} & = 2 \ 22\frac{1}{4} \text{ Ans.} \end{array}$$

### MULTIPLICATION OF VULGAR FRACTIONS:

**NOTE.** Cancelling, to abbreviate, should be used in this and the following rules in Vulgar Fractions : but a want of types prevents the introduction of that advantageous method in this work.

[1]  $\frac{3}{7} \times \frac{3}{11} = \frac{9}{77}$  Ans. Or,  $\frac{3}{7} \times \frac{3}{11} = \frac{3 \times 3}{7 \times 11} = \frac{9}{77}$  Ans.

$$[2] \quad \frac{4}{8} \times \frac{7}{9} = \frac{28}{72} \text{ Ans.}$$


---

$$[3] \quad \frac{1}{3} \text{ of } \frac{4}{5} \times \frac{7}{10} \text{ of } \frac{11}{12} = \frac{1 \times 4 \times 7 \times 11}{3 \times 5 \times 10 \times 12} = \frac{308}{1800} \text{ Ans.}$$


---

$$[4] \quad 7\frac{1}{2} \times 8\frac{1}{2} = \frac{29 \times 17}{4 \times 2} = \frac{493}{8} = 61\frac{5}{8} \text{ Ans.}$$


---

$$[5] \quad 4\frac{1}{2} \times \frac{1}{2} = \frac{9}{2} \times \frac{1}{2} = \frac{9}{4} \text{ Ans.}$$


---

$$[6] \quad \frac{7}{8} \times 13\frac{9}{10} = \frac{7}{8} \times \frac{139}{10} = \frac{973}{80} = 12\frac{13}{80} \text{ Ans.}$$


---

$$[7] \quad \frac{1}{2} \text{ of } 7 \times \frac{3}{6} = \frac{1 \times 7 \times 3}{2 \times 1 \times 6} = \frac{21}{12} = 1\frac{7}{4} \text{ Ans.}$$


---

$$[8] \quad \frac{3}{5} \text{ of } 8 \times \frac{7}{8} \text{ of } 5 = \frac{24}{5} \times \frac{35}{8} = \frac{840}{40} = 21 \text{ Ans.}$$


---

$$[9] \quad \frac{3}{6} \times \frac{4}{9} \text{ of } 11 = \frac{3}{6} \times \frac{44}{9} = \frac{132}{54} = 2\frac{4}{9} \text{ Ans.}$$


---

$$[10] \quad \frac{4}{5} \text{ of } 91 \times 71\frac{1}{2} = \frac{364}{5} = \frac{143}{2} = \frac{52052}{10} = 5205\frac{2}{10} \text{ Ans.}$$


---

$$[11] \quad 12\frac{3}{5} \times \frac{2}{6} \text{ of } 7 = \frac{63}{5} \times \frac{14}{6} = \frac{882}{30} = 29\frac{12}{30} \text{ Ans.}$$


---

$$[12] \quad 7\frac{1}{2} \times 9\frac{1}{2} = \frac{15}{2} \times \frac{37}{4} = \frac{555}{8} = 69\frac{3}{8} \text{ Ans.}$$

## DIVISION OF VULGAR FRACTIONS.

PERHAPS the following rule is preferable to that in DILWORTH.

Invert the divisor and proceed by the rule of multiplication.

$$[1] \quad \frac{17}{21} \div \frac{3}{5} = \frac{17}{21} \times \frac{5}{3} = \frac{85}{63} = 1\frac{22}{63} \text{ Ans.}$$

$$[2] \quad \frac{13}{19} \div \frac{7}{9} = \frac{13}{19} \times \frac{9}{7} = \frac{117}{133} \text{ Ans.}$$

$$[3] \quad \frac{14}{18} \div \frac{7}{10} = \frac{14}{18} \times \frac{10}{7} = \frac{140}{126} = 1\frac{14}{126} \text{ Ans.}$$

$$[4] \quad 1\frac{1}{2} \div 4\frac{8}{10} = \frac{3}{2} \div \frac{48}{10} = \frac{3}{2} \times \frac{10}{48} = \frac{30}{96} \text{ Ans.}$$

$$[5] \quad \frac{7}{8} \div \frac{4}{1} = \frac{7}{8} \times \frac{1}{4} = \frac{7}{32} \text{ Ans.}$$

$$[6] \quad \frac{4}{1} \div \frac{7}{8} = \frac{4}{1} \times \frac{8}{7} = \frac{32}{7} = 4\frac{4}{7} \text{ Ans.}$$

$$[7] \quad \frac{99}{1} \div \frac{108}{1} = \frac{99}{1} \times \frac{1}{108} = \frac{99}{108} \text{ Ans.}$$

$$[8] \quad \frac{1}{5} \text{ of } 19 \div \frac{2}{3} \text{ of } \frac{3}{4} = \frac{19}{5} \div \frac{3}{4} = \frac{19}{5} \times \frac{4}{3} = \frac{76}{15} = 5\frac{4}{15} \text{ Ans.}$$

$$[9] \quad \frac{1}{2} \text{ of } \frac{2}{3} \div \frac{2}{3} \text{ of } \frac{3}{4} = \frac{2}{6} \div \frac{6}{12} = \frac{2}{6} \times \frac{12}{6} = \frac{24}{36} = \frac{2}{3} \text{ Ans.}$$

$$[10] \quad \frac{2}{3} \text{ of } \frac{3}{4} \div \frac{1}{2} \text{ of } \frac{2}{3} = \frac{6}{12} \div \frac{6}{12} = \frac{6}{12} \times \frac{12}{6} = \frac{36}{24} = 1\frac{1}{2} \text{ Ans.}$$

$$[11] \quad 4\frac{1}{2} \div \frac{2}{3} \text{ of } 4 = \frac{9}{2} \div \frac{8}{3} = \frac{9}{2} \times \frac{3}{8} = \frac{27}{16} = 1\frac{11}{16} \text{ Ans.}$$

$$[12] \quad \frac{2}{3} \text{ of } 4 \div 4\frac{1}{2} = \frac{8}{3} \div \frac{9}{2} = \frac{8}{3} \times \frac{2}{9} = \frac{16}{27} \text{ Ans.}$$

# THE SINGLE RULE OF THREE DIRECT IN VULGAR FRACTIONS.

$$[1] \quad \begin{array}{l} lb. \quad s. \quad lb. \quad 32 \times 7 \times 13 \quad 2912 \quad d. \\ \frac{11}{13} : \frac{7}{13} :: \frac{32}{43} : \frac{\quad}{43 \times 15 \times 11} s. = \frac{\quad}{7095} s. = 4\frac{3}{4} + \frac{4871}{7095} \end{array} \quad \text{Ans.}$$

$$[2] \quad \begin{array}{l} E. \quad \ell. \quad E. \quad 12 \times 2 \times 5 \quad 120 \quad s. \quad d. \\ \frac{2}{3} : \frac{2}{3} :: \frac{12}{17} : \frac{\quad}{17 \times 3 \times 3} \ell. = \frac{\quad}{153} l. = 15 \quad 8\frac{86}{153} \end{array} \quad \text{Ans.}$$

$$[3] \quad \begin{array}{l} E. \quad \ell. \quad E. \quad 1 \times 7 \times 7 \quad 49 \quad s. \quad d. \\ \frac{4}{7} : \frac{7}{13} :: 1 : \frac{\quad}{1 \times 13 \times 4} \ell. = \frac{\quad}{52} \ell. = 18 \quad 10\frac{5}{8} \end{array} \quad \text{Ans.}$$

$$[4] \quad \begin{array}{l} oz. \quad s. \quad oz. \quad 3 \times 197 \times 1 \quad 591 \quad s. \quad d. \\ \frac{2}{7} : 16\frac{5}{12} :: \frac{3}{4} : \frac{\quad}{4 \times 12 \times 2} s. = \frac{\quad}{96} s. = 6 \quad 1\frac{3}{2} + \frac{1}{2} \end{array} \quad \text{Ans.}$$

$$[5] \quad \begin{array}{l} y. \quad s. \quad y. \quad 37 \times 18 \times 2 \quad 1332 \quad \ell. \quad s. \quad d. \\ 6\frac{1}{2} : 18 :: 9\frac{1}{2} : \frac{\quad}{4 \times 1 \times 13} s. = \frac{\quad}{52} s. = 1 \quad 5 \quad 7\frac{1}{2} + \frac{11}{2} \end{array} \quad \text{Ans.}$$

$$[6] \quad \begin{array}{l} Dol. \quad d. \quad Dol. \quad 500 \times 283 \quad 141500 \quad d. \quad \ell. \quad s. \quad d. \\ 1 : 56\frac{1}{2} :: 500 : \frac{\quad}{1 \times 5} d. = 28300 = 117 \quad 18 \quad 4 \end{array} \quad \text{Ans.}$$

$$[7] \quad \begin{array}{l} y. \quad s. \quad y. \quad 65 \times 9 \times 4 \quad 2340 \quad s. \quad \ell. \quad s. \\ 1\frac{1}{2} : 9 :: 16\frac{1}{2} : \frac{\quad}{4 \times 1 \times 5} s. = \frac{\quad}{20} s. = 117 \quad 5 \quad 17 \end{array}$$

$$[8] \quad \begin{array}{l} P. \quad s. \quad P. \quad 100 \times 86 \quad 8600 \quad s. \quad \ell. \\ 1 : 17\frac{1}{5} :: 100 : \frac{\quad}{1 \times 5} s. = 1720 = 86 \end{array} \quad \text{Ans.}$$

$$[9] \quad \begin{array}{l} oz. \quad \ell. \quad oz. \quad 1 \times 11 \times 7 \quad 77 \quad \ell. \quad s. \quad d. \\ \frac{4}{7} : \frac{11}{12} :: 1 : \frac{\quad}{1 \times 12 \times 5} \ell. = \frac{\quad}{60} \ell. = 1 \quad 5 \quad 8 \end{array} \quad \text{Ans.}$$

$$[10] \quad \begin{array}{l} oz. \quad s. \quad oz. \quad 251 \times 11 \quad 2761 \quad s. \\ 1 : 5\frac{1}{2} :: 16\frac{11}{15} : \frac{\quad}{15 \times 2} s. = \frac{\quad}{30} s. = 92\frac{1}{30} = \\ \ell. 4 \quad 12 \quad 0\frac{1}{2} + \frac{3}{5} \end{array} \quad \text{Ans.}$$



$$[18] \quad \begin{array}{ccccccc} \text{lb. s.} & \text{lb.} & & \text{s.} & \text{l. s.} & & \\ 1 : 8\frac{1}{2} :: 120 : \frac{120 \times 69}{1 \times 8} \text{ s.} = 1035 = 51 \text{ 15 the prime} \end{array}$$

cost. £.70 — £.51 15s. = £.18 5s. the whole gain.

$$\begin{array}{ccccccc} \text{£.} & \text{£.} & \text{£.} & & & & \text{l. s. d.} \\ 51\frac{15}{20} : 18\frac{5}{20} :: 100 : \frac{100 \times 365 \times 20}{1 \times 20 \times 1035} \text{ £.} = \frac{36500}{1035} \text{ £.} = 35 \text{ 5 } 3\frac{1}{2} \end{array}$$

+ 7 $\frac{1}{2}$ %, the gain per cent.

### THE SINGLE RULE OF THREE INVERSE IN VULGAR FRACTIONS.

$$[1] \quad \begin{array}{ccccccc} \text{y.} & \text{y.} & \text{y.} & & & & \text{y.} \\ 1\frac{1}{5} : 3\frac{1}{4} :: \frac{4}{3} : \frac{\frac{1}{5} \times 13 \times 6}{4 \times 4 \times 5} \text{ y.} = \frac{39}{8} \text{ y.} = 4\frac{7}{8} \text{ Ans.} \end{array}$$

$$[2] \quad \begin{array}{ccccccc} \text{m.} & \text{da.} & \text{m.} & & & & \text{days} \\ 1\frac{1}{2} : 28\frac{1}{2} :: 1\frac{1}{2} : \frac{1 \times 85 \times 16}{12 \times 3 \times 1} \text{ da.} = \frac{1360}{36} \text{ da.} = 37\frac{28}{36} \text{ Ans.} \end{array}$$

$$[3] \quad \begin{array}{ccccccc} \text{y.} & \text{y.} & \text{y.} & & & & \text{yds.} \\ 1\frac{1}{4} : 20\frac{1}{2} :: \frac{3}{4} : \frac{4 \times 41 \times 5}{3 \times 2 \times 4} \text{ y.} = \frac{820}{24} \text{ y.} = 34\frac{5}{6} \text{ Ans.} \end{array}$$

$$[4] \quad \begin{array}{ccccccc} \text{s.} & \text{fis.} & \text{s.} & & & & \text{fis.} \\ 12\frac{1}{2} : 240\frac{1}{7} :: 20\frac{1}{2} : \frac{8 \times 1681 \times 25}{161 \times 7 \times 2} \text{ fis.} = \frac{336200}{2254} \text{ fis.} \\ = 149\frac{145}{2254} \text{ fis. Ans.} \end{array}$$

$$[5] \quad \begin{array}{ccccccc} \text{y.} & \text{y.} & \text{y.} & & & & \text{yds.} \\ \frac{3}{4} : 20 :: 1\frac{1}{2} : \frac{\frac{1}{2} \times 20 \times 3}{5 \times 1 \times 4} \text{ y.} = 12 \text{ Ans.} \end{array}$$



## THE DOUBLE RULE OF THREE IN VULGAR FRACTIONS.

$$\begin{array}{lcl}
 \text{[1]} & \begin{array}{l} \text{st. da. } \text{£.} \\ 9 : 18 :: 10\frac{7}{9} : \\ 20 : 30 \text{ ---} \end{array} & \begin{array}{l} 97 \times 20 \times 30^5 \times 1 \times 1 \\ \frac{9700}{9 \times 1 \times 1 \times 9 \times 18} \text{ £.} = \frac{9700}{243} \text{ £.} = \\ \text{l. s. d.} \end{array} \\
 & & 39 \text{ } 18 \text{ } 4\frac{60}{243}^* \text{ Ans.}
 \end{array}$$

$$\begin{array}{lcl}
 \text{[2]} & \begin{array}{l} \text{m. } \text{da. } \text{l.} \\ 3 : 19\frac{1}{2} :: 8\frac{9}{16} : \\ 20 : 100\frac{1}{4} \text{ ---} \end{array} & \begin{array}{l} 89 \times 20 \times 40^{\frac{1}{2}} \times 1 \times 2 \\ \frac{35689}{10 \times 1 \times 4 \times 3 \times 39} \text{ £.} = \frac{35689}{117} \text{ £.} = \\ \text{l. s. d.} \end{array} \\
 & & 305 \text{ } 0 \text{ } 8\frac{24}{117} \text{ Ans.}
 \end{array}$$

$$\begin{array}{lcl}
 \text{[3]} & \begin{array}{l} \text{per. da. s.} \\ 2 : 1 :: 4\frac{5}{8} : \\ 4 : 10\frac{1}{2} \text{ ---} \end{array} & \begin{array}{l} 37 \times 4^1 \times 2 \times 1 \times 1 \\ \frac{777}{8 \times 1 \times 2 \times 2} \text{ s.} = \frac{777}{8} \text{ s.} = 4 \text{ } 17 \text{ } 1\frac{1}{2}. \\ \text{Ans.} \end{array}
 \end{array}$$

$$\begin{array}{lcl}
 \text{[4]} & \begin{array}{l} \text{per. w. gal.} \\ 5 : 1 :: 7\frac{4}{5} : \\ 8 : 22\frac{1}{2} \text{ ---} \end{array} & \begin{array}{l} 39 \times 8^4 \times 45^9 \times 1 \\ \frac{1404}{5 \times 1 \times 2 \times 5} \text{ gal.} = \frac{1404}{5} \text{ gal.} = 280\frac{4}{5}. \\ \text{Ans.} \end{array}
 \end{array}$$

$$\begin{array}{lcl}
 \text{[5]} & \begin{array}{l} \text{per. w. l.} \\ 14 : 20 :: 40\frac{4}{5} : \\ 46 \text{ ---} \end{array} & \begin{array}{l} 14^{\frac{1}{2}} \times 20^5 \times 143 \times 5 \times 1 \\ \frac{3575}{1 \times 1 \times 7 \times 204 \times 46} \text{ w.} = \frac{3575}{1173} \text{ w.} \\ \text{---} \end{array} \\
 & & = 3\frac{56}{1173} \text{ weeks. Ans.}
 \end{array}$$

$$\begin{array}{lcl}
 \text{[6]} & \begin{array}{l} \text{sa. mo. l.} \\ 3 : 9\frac{1}{4} :: 40\frac{3}{5} : \\ 100 : 28\frac{3}{7} :: \text{---} \end{array} & \begin{array}{l} 603^{\frac{67}{201}} \times 100^{20} \times 199 \times 1 \times 4 \\ \frac{1066640}{15 \times 1 \times 7 \times 3 \times 37} \text{ l.} = \frac{1066640}{259} \text{ l.} \\ \text{---} \end{array} \\
 & & = 4118 \text{ l. } 6 \text{ s. } 0\frac{1}{4} \text{ d. } + \frac{29}{335} \text{ Ans.}
 \end{array}$$

\* The fractional remainders in this and many other rules are obtained in lower terms than in DILWORTH.

# A KEY TO DILWORTH'S ARITHMETIC.

## PART III.

### DECIMAL FRACTIONS.

#### ADDITION OF DECIMALS.

<i>Shillings.</i>	<i>Yards.</i>	<i>Gallons.</i>	<i>l.</i>
47.0279	943.0054	7817.4951	318.9421
<i>Miles.</i>	<i>lb.</i>	<i>Acres.</i>	<i>Ounces.</i>
230.0325	49.48331	3.80591	54.5421

#### SUBTRACTION OF DECIMALS.

<i>Years.</i>	<i>Days.</i>	<i>Weeks.</i>	<i>Hours.</i>
1071.76088	704.97909	6.19	11.88
<i>Minutes.</i>	<i>Months.</i>	<i>Ells.</i>	<i>Tons.</i>
172.629	6093.891	.1726032	742.9697

#### MULTIPLICATION OF DECIMALS.

[1]	[2]	[3]	[4]	[5]
.612	48.	37.9	.121	1.81
4.12	.48	46.5	17.2	71.
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
1224	384	1895	242	181
612	192	2274	844	1267
2448	<hr/>	1516	121	<hr/>
<hr/>	23.04	<hr/>	<hr/>	128.51
2.52144	<hr/>	1762.35	2.0782	<hr/>
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
[6]	[7]	[8]	[9]	[10]
4.1	.00071	.00041	.0027	410.
1.42	.121	.00017	41.	.0012
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
82	71	287	27	4920
.164	852	41	108	<hr/>
41	<hr/>	<hr/>	<hr/>	<hr/>
<hr/>	.00008591	.0000000697	.1107	<hr/>
5.822	<hr/>	<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>

[11]	[12]	[13]	[14]
.07	1.007	4.001	.004
.07	.041	.004	.004
<hr/>	<hr/>	<hr/>	<hr/>
.0049	1007	.016004	.000016
<hr/>	4028	<hr/>	<hr/>
	<hr/>		
	.041287		
	<hr/>		

## DIVISION OF DECIMALS.

[1]	[4]
37.5)19.4000(.517+	41.)76212(.01858+
1875	41
<hr/>	<hr/>
650	352
375	328
<hr/>	<hr/>
2750	241
2625	205
<hr/>	<hr/>
125	362
	328

$$\begin{array}{r} 47. ) 47121.1 ( 1002.5 + \\ 47 \end{array}$$

121  
94

271

235

36

$$\begin{array}{r} .1812 ) 4.1800 ( 23. + \\ 3624 \end{array}$$

5560

5436

124

$$\begin{array}{r} 7.21 ) .612812 ( .849 + \\ 5768 \end{array}$$

3601

2884

7172

6489

683

$$\begin{array}{r} \text{[6]} \\ .721)121819(.168+ \\ \underline{721} \end{array}$$

$$\begin{array}{r} 4971 \\ \underline{4326} \end{array}$$

$$\begin{array}{r} 6459 \\ \underline{5768} \end{array}$$

$$\begin{array}{r} 691 \end{array}$$

$$\begin{array}{r} \text{[7]} \\ .7121)9.00000(12.6+ \\ \underline{7121} \end{array}$$

$$\begin{array}{r} 18790 \\ \underline{14242} \end{array}$$

$$\begin{array}{r} 45480 \\ \underline{42726} \end{array}$$

$$\begin{array}{r} 2754 \end{array}$$

$$\begin{array}{r} \text{[8]} \\ .9)9.0 \\ \underline{\phantom{00}} \\ 10. \end{array}$$

$$\begin{array}{r} \text{[9]} \\ 47.81)14.00000(.295+ \\ \underline{9462} \end{array}$$

$$\begin{array}{r} 45380 \\ \underline{42579} \end{array}$$

$$\begin{array}{r} 28010 \\ \underline{23655} \end{array}$$

$$\begin{array}{r} 4355 \end{array}$$

$$\begin{array}{r} \text{[10]} \\ 863.)1.00000(.00115+ \\ \underline{863} \end{array}$$

$$\begin{array}{r} 1370 \\ \underline{863} \end{array}$$

$$\begin{array}{r} 5070 \\ \underline{4315} \end{array}$$

$$\begin{array}{r} 755 \end{array}$$

$$\begin{array}{r} \text{[11]} \\ .12)0.128100 \end{array}$$

$$\begin{array}{r} .10675 \end{array}$$

$$\begin{array}{r} \text{[12]} \\ .018)0.001212(.067+ \\ \underline{108} \end{array}$$

$$\begin{array}{r} 132 \\ \underline{126} \end{array}$$

$$\begin{array}{r} 6 \end{array}$$

### Case 1.

[3]

$$\frac{11}{14} \text{ of } \frac{10}{13} = \frac{11 \times 10^5}{14 \times 13} = \frac{55}{91}$$

$$\frac{11}{14} \text{ of } \frac{10}{13} = \frac{11 \times 10}{14 \times 13} = \frac{55}{91}$$

$$\begin{array}{cccc} 14 & 13 & 14 \times 13 & 91 \\ & & 7 & \end{array}$$

91.)  $55.0000000(.6043956 +$   
546 Ans.

546 **Ans.**

**Abstract**

400

364

360

273

870

819

510

455

550

546

4

[6]

**24 | 24.**

20	1.00
----	------

12 | .050000

$$lb. .004166 + Ans.$$

[7]

**16 | 14.0**

16	.8750000
----	----------

16. .0546875 Ans.

[8]

4 | 2.0

**20 | 4.5**

T. 225( ABF.

$$\begin{array}{r} [9] \\ 20 \overline{) 14.0} \\ \text{Ton. } .7 \text{ Ans.} \end{array}$$

$$\begin{array}{r} [10] \\ 16 \overline{) 174.} \\ 16 \overline{) 10.875} \\ 28 \left\{ \begin{array}{l} 4 \\ 7 \\ 4 \end{array} \right. \begin{array}{l} .6796875 \\ .1699218 \\ .0242745 \end{array} \\ \text{Ans. } .0060686 + \text{Cwt.} \end{array}$$

$$\begin{array}{r} [11] \\ 12 \overline{) 4.000} \\ 3 \overline{) .3333 \text{ \&c.}} \\ \text{Ans. } .1111 + \text{\&c. yd.} \end{array}$$

$$\begin{array}{r} [12] \quad \text{mile.} \\ 1760 \overline{) 76.000000} (.043181 + \\ 7040 \quad \text{Ans.} \end{array}$$

$$\begin{array}{r} 5600 \\ 5280 \end{array}$$

$$\begin{array}{r} 3200 \\ 1760 \end{array}$$

$$\begin{array}{r} 14400 \\ 14080 \end{array}$$

$$\begin{array}{r} 3200 \\ 1760 \end{array}$$

$$\begin{array}{r} 1440 \end{array}$$

$$\begin{array}{r} [13] \\ 3 \overline{) 1.0000} \\ \text{Ans. } .3333 + \text{league.} \end{array}$$

$$\begin{array}{r} [14] \\ 4 \overline{) 2.0} \\ 4 \overline{) 3.500} \\ \text{Ans. } .875 \text{ yard.} \end{array}$$

$$\begin{array}{r} [15] \\ 40 \overline{) 4.0} \\ 4 \overline{) .100} \\ \text{Ans. } .025 \text{ acre.} \end{array}$$

$$\begin{array}{r} [16] \\ 8 \overline{) 1.000} \\ \text{Ans. } .125 \text{ gal.} \end{array}$$

$$\begin{array}{r} [17] \\ 63 \left\{ \begin{array}{l} 9 \\ 7 \end{array} \right. \begin{array}{l} 1.000000 \\ .111111 \end{array} \\ \text{Ans. } .015873 + \text{Hhd.} \end{array}$$

$$\begin{array}{r} [18] \\ 60 \overline{) 7.0000000} \\ 24 \left\{ \begin{array}{l} 4 \\ 6 \end{array} \right. \begin{array}{l} .1166666 \\ .0291666 \end{array} \\ \text{Ans. } .0048611 + \text{day.} \end{array}$$

$$\begin{array}{r} [19] \\ 7 \overline{) 2.0000000} \\ \text{Ans. } .2857142 + \text{w.} \end{array}$$

$$\begin{array}{r} [20] \quad \text{year.} \\ 365 \overline{) 72.0000} (.1972602 + \\ 365 \quad \text{Ans.} \end{array}$$

$$\begin{array}{r} 3550 \\ 3285 \end{array}$$

$$\begin{array}{r} 2650 \\ 2555 \end{array}$$

$$\begin{array}{r} 950 \\ 730 \end{array}$$

$$\begin{array}{r} 2200 \\ 2190 \end{array}$$

$$\begin{array}{r} 1000 \\ 730 \\ \hline 270 \end{array}$$

Case 2.—1st part.

$$\begin{array}{r}
 [1] \quad .76\text{l.} \\
 \quad 20 \\
 \hline
 15.20 \\
 \quad 12 \\
 \hline
 2.40 \\
 \quad 4 \\
 \hline
 1.60 \\
 \text{s. d. gr.} \\
 15 \ 2 \ 1.6 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 [2] \quad C. \\
 \quad .861 \\
 \quad 4 \\
 \hline
 3.444 \\
 \quad 28 \\
 \hline
 3552 \\
 \quad 888 \\
 \hline
 12.432 \\
 \quad 16 \\
 \hline
 6.912 \\
 \quad 16 \\
 \hline
 14.592 \\
 \text{gr. lb. oz. dr.} \\
 3 \ 12 \ 6 \ 14.592 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 [3] \quad .461\text{s.} \\
 \quad 12 \\
 \hline
 5.532 \\
 \quad 4 \\
 \hline
 2.128 \\
 \text{d. grs.} \\
 5 \ 2.128 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 [4] \quad Hhd. \\
 \quad .761 \\
 \quad 63 \\
 \hline
 2283 \\
 4566 \\
 \hline
 47.943 \\
 \quad 4 \\
 \hline
 3.772 \\
 \quad 2
 \end{array}$$

$$\begin{array}{r}
 1.544 \\
 \text{gal. qts. pts.} \\
 47 \ 3 \ 1.544 \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 [5] \quad T. \\
 \quad .17 \\
 \quad 4 \\
 \hline
 .68 \\
 \quad 63 \\
 \hline
 204 \\
 408 \\
 \hline
 42.84 \\
 \quad 4 \\
 \hline
 3.36
 \end{array}$$

$$\begin{array}{r}
 \text{gal. qts.} \\
 42 \ 3.36 \text{ Ans.}
 \end{array}$$

[6] *day.*  
 .761  
 24  
 —  
 3044  
 1522  
 —  
 18.264  
 60  
 —  
 15.840  
 60  
 —  
 50.400  
*h. m. sec.*  
 18 15 50.4 Ans.

[7] *lb.*  
 .7  
 12  
 —  
 8.4  
 20  
 —  
 8.0  
*oz. dwt.*  
 8 8 Ans.

[8] .71  
 4  
 —  
 2.84  
 20  
 —  
 16.80  
 24  
 —  
 19.20  
*oz. dwt. grs.*  
 2 16 19.2 Ans.

[9] .67 *lb.*  
 3  
 —  
 2.01  
 8  
 —  
 0.08  
 40  
 —  
 3.20  
 5½  
 —  
 1.10  
 3  
 —  
 0.30  
 12  
 —  
 3.60  
 3  
 —  
 1.80  
*m. fu. po. yd. ft. in. bc.*  
 2 0 3 1 0 3 1.8 Ans.

[10] *fur.*  
 .712  
 40  
 —  
 28.480  
 5½  
 —  
 2400  
 240  
 —  
 2.640  
 3  
 —  
 1.920  
 12  
 —  
 11.040  
*po. yd. ft. in.*  
 28 2 1 11.04 Ans.



[11]

.07

32

---

2.24

8

---

1.92*gal. ft.*

2 1.92 Ans.

[12]

.4712

5

---

2.3560

4

---

1.4240*gr. na.*

2 1.424 Ans.

[13]

*Hhd. B.*

.72

54

---

288

360

---

38.88

4

---

3.52*gal. qts.*

38 3.52 Ans.

[14]

*T.*

.61

4

---

2.44

63

---

132

264

---

27.72

4

---

2.88

2

---

1.76*bhd. gal. qt. ft.*

2 27 2 1.76 Ans.

[15]

4 | 2.

3.5

.092

---

79

315

---

3220

4

---

1.2880

40

---

11.5200*R. no.*

1 11.52 Ans.

[16] *ch.*  
 .461  
 36  


---

 2766  
 1383  


---

 16.596  
 4  


---

 2.384  
*bu. fiec.*  
 16 2.384 Ans.

[17] *gr.*  
 .712  
 3  


---

 2.136  
 8  


---

 17.088  
 4  


---

 .352  
 2  


---

 .704  
 4  


---

 2.816  
*bu. qts.*  
 17 2.816 Ans.

[18] *yr.*  
 .3  
 365  


---

 109.5  
 24  


---

 12.0  
*da. h.*  
 109 12 Ans.

[19] *.5hr.*  
 60  


---

 30.0  
 Ans. 30 min.

[20] *£.*  
 12.4  
 9  


---

 111.6  
 20  


---

 12.0  
 111£. 12s. Ans.

*Case 2.—2d part.*  
 [1] .48  
 20  


---

 9.60  
 .16  


---

 9.76  
 12  


---

 9.12  
 9s. 9.12d. Ans.

[2] .17  
 12  


---

 2.04  
 .84  


---

 2.88  
 .20  


---

 17.60  
 24  


---

 14.40  
*oz. dwt. gr.*  
 2 17 14.4 Ans.

[3]

28 | .700 *lb.*

---

.025

.17

---

4 | .195 *gr.*

---

.04875

.19

---

20 | .23875 *Cwt.*

---

.0119375

.17

---

.1819375 *Ton.*

20

---

3.6387500

4

---

2.5550000

28

---

4440

1110

---

15.540

*C. gr. lb.*

3 2 15.54 *Ans.*

[4] .17 *s.*

20

---

3.40

.7

---

2.70

12

---

8.40

4

---

1.60

*s. d. gr.*

2 8 1.6 *Ans.*

---

[5] .41

24

---

164

82

---

9.84

.16

---

9.68

60

---

40.80

60

---

48.00

*h. m. sec.*

9 40 48 *Ans.*

# THE SINGLE RULE OF THREE DIRECT IN DECIMALS.

[1]  
*lb.*    *s.*    *lb.*  
 1.4 : 14.5 : 75.31  
           14.5

37655  
 30124  
 7531

1.4 | 1091.995

.7 | 545.9975

20 | 77,9.996

12  
 38.19  
 11.952  
 4

3.808

*£.*   *s.*   *d.*  
 38 19 11 $\frac{3}{4}$  + Ans.

[3]  
*lb.*    *s.*    *lb.*  
 1.5 : 7.8 :: 9.7  
       .5 : 2.6 :: 12

116.4  
 2.6

6984  
 2328

.5 | 302 640

2,0 | 60,5.28

12  
 30 5  
 3.36  
 4

1.44

*£.*   *s.*   *d.*   *gr.*  
 30 5 3 1.44 Ans.

[2]

*C.*   *gr.*   *lb.*  
 11 3 10.12  
           3

*C.*   *£.*   *s.*  
 1.6 : 3 12.76 :: 35 2 2.36  
       4    20            4

6.4    72.76    142  
 28            28

512            1138.36  
 128            284

179.2            3978.36

3978.36  
72.76

2887016  
2784852  
795672  
2784852

179.2)289465.4736<sup>30</sup>(161,5.320

1792 12

80 15

11026 3.840

10752 4

2745 3.360

1792

9534

8960

5747

5376 £.80 15 3 $\frac{1}{4}$ + Ans.

3713

3584

1296

[4]

C. £. lb.  
1.47 : 4.5 :: 1.7  
4 20 90.

5.88 90.0 153.0  
28 12

d.

4704 164.64)1836.000(11.1+  
1176 16464 Ans.

164.64 18960  
16464  
24960  
16464  
8496

[5]

pt. s. hhd.  
1 : 1.2 :: 12.5  
63

375  
750

787.5  
8

6300.0  
1.2

2,0)756,0.0  
£.378 Ans.

[6]  
*lb. s. d. C. gr. lb.*  
 8.4 : 16 4.6 :: 4 2 7.4  
           12                   3

196.6      13 2 22.2  
                   4

54  
28

454.2  
108

1534.2  
196.6

92052

92052

138078

15342

                  13  
 8.4)301623.72(35907.5  
       252

          2,0)299,2 3½

496

420      £.149 12 3½+  
                   Ans.

762

756

637

588

492

420

72

[7]  
*yd.*  
 21.5  
       3

*yd. s.*  
1 : 12.3 :: 64.5  
                   12.3

1935  
7740

2,0)79,3.35  
                   12  
£.39 13  
                   4.20

*£. s. d.*  
39 13 4.2      Ans.

[8]  
*s. d. yd. £. s.*  
 4 2.6 : 1 :: 6 13.12  
 12                   20

50.6                   133.12  
                           12

                  yd.  
 50.6)1597.44(31.569  
           1518      Ans.

794

506

2884

2530

3540

3036

5040

4554

486

5.8 *tons.*

[9]

4

23.2

63

696

1392

1461.6

50.9

*£. Gal.*

1410.7 : 60.4 :: 1

20

1208.0

12

*d.*1410.7)14496.0(10.27 +  
14107                      Ans.

38900

28214

106860

98749

8111

[10] 25.6

4.5

1280

1024

*y.*                      *y.*

40.7 : 115.20 :: 1

1

40.7)115.20(2.8304

814

12

3380

9.9648

3256

4

1240

3.9592

1221

1900

1628

Ans. 2s. 9½d. +

7.6

[11]

40.1

304.76s. prime cost.

*lb. d. C.*

1 : 4.5 :: 7.6

112.

152

836

851.2

4.5

42560

34048

12)3830.40

319.20

304.76

14.44

12

5.28

4

1.12

Ans. *s. d. gr.*  
14 5 1.12 gain.

[12] 90.46.

10.

*s. B.*

26.7 : 1 :: 100.4

20

26.7)2008.0(75.2059

1869

36

1390

12354

1335

6177

550

7.4124

534

1600

1335

2650

2403

Ans. 75 bar. 7.4 gal. +

$$\begin{array}{r} \text{lb.} \quad \text{s.} \quad \text{C. gr.} \\ 1 : 2.75 :: 3 \text{ } 1.5 \\ \quad \quad \quad 4 \end{array}$$

13.5

28

1080

270

378.0

2.75

1890

2646

756

$$2,0)103,9.50$$

12

51 19 6.00

60 11 6

$$\text{Ans.} \quad \text{£. } 8 \text{ } 12 \text{ } 0 \quad \text{gain.}$$

$$[14] \quad \begin{array}{r} 10.75\text{s.} \\ 8.5 \end{array}$$

$$\begin{array}{r} \text{y.} \quad \text{y.} \\ 1 : 2.25 :: 436 \\ \quad \quad 436 \end{array}$$

1350

675

900

$$2,0)98,1.00$$

$$\text{Ans.} \quad \text{£. } 49 \text{ } 1\text{s.} \quad \text{gain.}$$

$$[13] \quad \begin{array}{r} \text{s.} \quad \text{s.} \quad \text{£.} \\ 20 : 7.5 :: 296.85 \\ \quad \quad \quad 7.5 \end{array} \quad [15]$$

148425

207795

$$20)2226.3750$$

111.31875

20

6.37500

12

4.500

4

2.0

$$\text{Ans.} \quad \text{£. } 111 \text{ } 6 \text{ } 4\frac{1}{2}.$$

$$[16] \quad \begin{array}{r} \text{C. gr.} \\ 4 \text{ } 1.9 \\ \quad \quad 3 \end{array}$$

$$20 \left| \begin{array}{r} 16. \\ 7.8 \\ 5.6 \end{array} \right. \begin{array}{r} 13 \text{ } 1.7 \\ 4 \end{array}$$

$$\text{gr.} \quad \text{---} \quad \text{---}$$

$$4 : 2.2 :: 53.7 \\ \quad \quad 2.2$$

1074

1074

$$4)118.140$$

29.535

20

10.700

12

8.400

4

1.60

$$\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \quad \text{gr.} \\ 29 \text{ } 10 \text{ } 8 \text{ } 1.6 \end{array} \quad \text{Ans.}$$



# SQUARE ROOT.

185

[17]  $\begin{array}{r} \text{gr. s.} \quad \text{oz.} \\ 1 : 3.25 :: 1.5 \\ \hline 20 \\ \hline 30.0 \\ 24 \\ \hline 720 \\ 3.25 \\ \hline 3600 \\ 1440 \\ 2160 \\ \hline 20)2340.00 \end{array}$

$\begin{array}{r} 20)2340.00 \\ \hline \text{G.} \quad 117. \\ 60 = 63 \\ \hline \text{[gain.} \\ 6.54 \text{ whole} \\ \hline \text{£.} \quad \text{£.} \quad \text{£.} \\ 63 : 54 :: 100 \\ 7 : 6 :: 100 \\ 100 \\ \hline 7)600 \\ \hline \text{Gain per ct. £.85 } 14 \text{ } 3\frac{1}{4} \text{ } .7 + \end{array}$

# SQUARE ROOT.

[1]  $\begin{array}{r} 171 \\ 17.1 \\ \hline 171 \\ 1197 \\ 171 \\ \hline \text{Ans. } 292.41 \end{array}$

[2]  $\begin{array}{r} .09 \\ .09 \\ \hline \text{Ans. } .0081 \end{array}$

[3]  $\begin{array}{r} .0094 \\ .0094 \\ \hline 376 \\ 846 \\ \hline \text{An. } .00008836 \end{array}$

[4]  $\begin{array}{r} 6 \mid 4712.812610(68.649 + \\ 6 \mid 35 \\ \hline \text{Ans.} \end{array}$

$\begin{array}{r} 128 \mid 1112 \\ 8 \mid 1024 \\ \hline \end{array}$

$\begin{array}{r} 1366 \mid 8881 \\ 6 \mid 8196 \\ \hline \end{array}$

$\begin{array}{r} 13724 \mid 68526 \\ 4 \mid 54896 \\ \hline \end{array}$

$\begin{array}{r} 137289 \mid 1363010 \\ \mid 1235601 \\ \hline 127309 \end{array}$

[5]  $\begin{array}{r} 9 \mid 9712.718051(98.553 + \\ 9 \mid 81 \\ \hline \text{Ans.} \end{array}$

$\begin{array}{r} 188 \mid 1612 \\ 8 \mid 1504 \\ \hline \end{array}$

$\begin{array}{r} 1965 \mid 10871 \\ 5 \mid 9825 \\ \hline \end{array}$

$\begin{array}{r} 19705 \mid 104680 \\ 5 \mid 98525 \\ \hline \end{array}$

$\begin{array}{r} 197103 \mid 615551 \\ \mid 551309 \\ \hline 64242 \end{array}$

[6]  $\sqrt{3.17218120(1.78106 + \text{Ans.})}$

$$\begin{array}{r}
 1 \overline{) 3.17218120} \\
 \underline{1} \phantom{.00000000} \\
 27 \overline{) 217} \\
 \underline{7} \phantom{00} 189 \\
 348 \overline{) 2821} \\
 \underline{8} \phantom{00} 2784 \\
 3561 \overline{) 3781} \\
 \underline{1} \phantom{00} 3561 \\
 356206 \overline{) 2202000} \\
 \underline{2137236} \\
 64764
 \end{array}$$

[8]  $\sqrt{761.801216(27.6007 + \text{Ans.})}$

$$\begin{array}{r}
 2 \overline{) 761.801216} \\
 \underline{4} \phantom{.00000000} \\
 47 \overline{) 361} \\
 \underline{7} \phantom{00} 329 \\
 546 \overline{) 3280} \\
 \underline{6} \phantom{00} 3276 \\
 552007 \overline{) 4121600} \\
 \underline{3864049} \\
 257551
 \end{array}$$

[7]  $\sqrt{1.39761210(1.1822 + \text{Ans.})}$

$$\begin{array}{r}
 1 \overline{) 1.39761210} \\
 \underline{1} \phantom{.00000000} \\
 21 \overline{) 39} \\
 \underline{1} \phantom{00} 21 \\
 228 \overline{) 1876} \\
 \underline{8} \phantom{00} 1824 \\
 2362 \overline{) 5212} \\
 \underline{2} \phantom{00} 4724 \\
 23642 \overline{) 48810} \\
 \underline{47284} \\
 1526
 \end{array}$$

[9]  $\sqrt{.0007612816(.02759 + \text{Ans.})}$

$$\begin{array}{r}
 2 \overline{) .0007612816} \\
 \underline{2} \phantom{.00000000} \\
 47 \overline{) 361} \\
 \underline{7} \phantom{00} 329 \\
 545 \overline{) 3228} \\
 \underline{5} \phantom{00} 2725 \\
 5509 \overline{) 50316} \\
 \underline{49581} \\
 755
 \end{array}$$

[10]  $\sqrt{4.0000671210(2.000016 + \text{Ans.})}$

$$\begin{array}{r}
 2 \overline{) 4.0000671210} \\
 \underline{2} \phantom{.00000000} \\
 400001 \overline{) 0000671210} \\
 \underline{1} \phantom{00000000} 409001 \\
 4000026 \overline{) 27120900} \\
 \underline{24000156} \\
 3120744
 \end{array}$$

[11]  $\sqrt{472}$

[12]  $\sqrt{944}$

$\sqrt{3304}$

$\sqrt{1888}$

$\sqrt{222784} \text{ Ans.}$

$\sqrt{5625} \text{ Ans.}$

$$\begin{array}{r} \text{[13]} \\ 1 \overline{) 12544(112} \\ 1 \phantom{0000} \end{array}$$

$$\begin{array}{r} 21 \overline{) 25} \\ 1 \phantom{0} \end{array}$$

$$\begin{array}{r} 222 \overline{) 444} \\ 444 \end{array}$$

$$\begin{array}{r} \text{[14]} \\ 4 \overline{) 197136(444} \\ 4 \phantom{0000} \end{array}$$

$$\begin{array}{r} 84 \overline{) 371} \\ 4 \phantom{0} \end{array}$$

$$\begin{array}{r} 884 \overline{) 3536} \\ 3536 \end{array}$$

$$\begin{array}{l} \text{[15]} \\ 17 \times 17 = 289 \\ 20 \times 20 = 400 \end{array}$$

$$\begin{array}{r} \text{feet.} \\ 2 \overline{) 689(26.2+} \\ 2 \phantom{00} \end{array} \text{Ans.}$$

$$\begin{array}{r} 46 \overline{) 289} \\ 6 \phantom{0} \end{array}$$

$$\begin{array}{r} 522 \overline{) 1300} \\ 1044 \phantom{00} \\ \hline 256 \end{array}$$

THE SQUARE ROOT OF VULGAR FRACTIONS.

$$\begin{array}{r} 3044)6849(2 \\ 6088 \end{array}$$

[1]

761) $\frac{3044}{8819}(\frac{4}{9}$ ; and the square root of  $\frac{4}{9}$  is  $\frac{2}{3}$ . Ans. Or  $\sqrt{\frac{4}{9}} = \frac{2}{3}$ . Ans.

$$\begin{array}{r} 761)3044(4 \\ 3044 \end{array}$$

$$\begin{array}{r} 3456)5400(1 \\ 3456 \\ \hline 1944)3456(1 \\ 1944 \end{array} \quad \text{[2]}$$

216) $\frac{3456}{5100}(\frac{16}{35}$ ; and the square root of  $\frac{16}{35}$  is  $\frac{4}{5}$ . Ans.

$$\begin{array}{r} 1512)1944(1 \\ 1512 \\ \hline 432)1512(3 \\ 1296 \\ \hline 216)432(2 \\ 432 \end{array}$$

$$\begin{array}{r} 7056)9216(1 \\ 7056 \\ \hline 2160)7056(3 \\ 6480 \end{array} \quad \text{[3]}$$

144) $\frac{7056}{9916}(\frac{49}{84}$ ; and the square root of  $\frac{49}{84}$  is  $\frac{7}{8}$ . Ans.

$$\begin{array}{r} 576)2160(3 \\ 1728 \\ \hline 432)576(1 \\ 432 \\ \hline 144)432(3 \\ 432 \end{array}$$

[4]

SURDS.

6192)3168.0(.5116279069

30960

7200

6192

10080

6192

38880

37152

17280

12384

48960

43344

56160

55728

43200

37152

60480

55728

4752

7 | .5116279069(.71528 +

7 | 49

Ans.

141 | 216

1 | 141

1425 | 7527

5 | 7125

14302 | 40290

2 | 28604

143048)1168669

1144384

24285

[5]

272)208.0(.7647058823

1904

1760

1632

1280

1088

1920

1904

1600

1360

2400

2176

2240

2176

640

544

960

816

144

8 | .7647058823(.87447 +

8 | 64

Ans.

167 | 1247

7 | 169

1744 | 7805

4 | 6976

17484 | 82988

4 | 69936

174887 | 1305223

1224209

81014

738)387.0(.5243902439

[6]

$$\begin{array}{r}
 3690 \\
 \hline
 1800 \\
 1476 \\
 \hline
 3240 \\
 2952 \\
 \hline
 2880 \\
 2214 \\
 \hline
 6660 \\
 6642 \\
 \hline
 1800 \\
 1476 \\
 \hline
 3240 \\
 2952 \\
 \hline
 2880 \\
 2214 \\
 \hline
 6660 \\
 6642 \\
 \hline
 18 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 7 \overline{) .5243902439} (.72414 + \\
 7 \overline{) 49} \quad \text{Ans.} \\
 \hline
 142 \overline{) 343} \\
 2 \overline{) 284} \\
 \hline
 1444 \overline{) 5990} \\
 4 \overline{) 5776} \\
 \hline
 14481 \overline{) 21424} \\
 1 \overline{) 14481} \\
 \hline
 144824 \overline{) 694339} \\
 \phantom{144824} 579296 \\
 \hline
 \phantom{144824} 115043
 \end{array}$$

THE SQUARE ROOT OF MIXED NUMBERS.

[1]  $37\frac{36}{49} = \frac{37 \times 49 + 36}{49} = \frac{1813 + 36}{49} = \frac{1849}{49}$

$$\begin{array}{r}
 1849(43 \\
 16 \\
 \hline
 83)249 \\
 249
 \end{array}$$

$49(7$   
 $49$

and  $4\frac{1}{7} = 6\frac{1}{7}$ . Ans.

[2]  $17\frac{16}{25} = \frac{17 \times 25 + 16}{25} = \frac{425 + 16}{25} = \frac{441}{25}$ ; and the square root of  $4\frac{41}{25}$  is  $2\frac{1}{5} = 4\frac{1}{5}$ . Ans.

[3]  $5\frac{388}{21} = 5\frac{4}{3} = 4\frac{2}{3}$ ; and the square root of  $4\frac{2}{3}$  is  $2\frac{1}{3}$ . Ans.

## SURDS.

[4]  
 $76\frac{1}{7} = 76.82352941$ , &c. by  
 Case 1, Reduction of Decimals: and

$$\begin{array}{r|l} 8 & 76.82352941(8.7649 + \\ 8 & 64 \end{array} \quad \text{Ans.}$$

$$\begin{array}{r|l} 167 & 1282 \\ 7 & 1169 \end{array}$$

$$\begin{array}{r|l} 1746 & 11335 \\ 6 & 10476 \end{array}$$

$$\begin{array}{r|l} 17524 & 85929 \\ 4 & 70096 \end{array}$$

$$\begin{array}{r|l} 175289 & 1583341 \\ & 1577601 \end{array}$$

5740

[5]  
 $7\frac{9}{11} = 7.81818181$  and

$$\begin{array}{r|l} 2 & 7.81818181(2.7961 + \\ 2 & 4 \end{array} \quad \text{Ans.}$$

$$\begin{array}{r|l} 47 & 381 \\ 7 & 329 \end{array}$$

$$\begin{array}{r|l} 549 & 5281 \\ 9 & 4941 \end{array}$$

$$\begin{array}{r|l} 5586 & 34081 \\ 6 & 33516 \end{array}$$

$$\begin{array}{r|l} 55921 & 56581 \\ & 55921 \end{array}$$

660

## CUBE ROOT.

[1]

6.4

6.4

256

384

40.96

6.4

16384

24576

262.144 Ans.

[2]

.13

.13

39

13

.0169

.13

507

169

.002197 Ans.

# CUBE ROOT.

191

[3]	41.1	[4]	.09	[5]	.007
	41.1		.09		.007
	<u>411</u>		<u>.0081</u>		<u>.000049</u>
	411		.09		.007
	1644				
	<u>1689.21</u>		<u>.000729</u>	Ans.	<u>.000000343</u>
	41.1				
	168921				
	168921				
	675684				
	<u>69426.531</u>				
	Ans.				

[6]  
 $3aa = 3 \times 1 \times 1 = 3$   
 $3a = 3 \times 1 = 3$   
 7612.812161 (19.67+  
 Ans.

Divisor 33 6612 Resolvend.

$3aac = 3 \times 1 \times 1 \times 9 = 27$   
 $3cca = 3 \times 9 \times 9 \times 1 = 243$   
 $ccc = 9 \times 9 \times 9 = 729$

5859 Subtrahend.

$3aa = 3 \times 19 \times 19 = 1083$   
 $3a = 3 \times 19 = 57$

Divisor 10887 753812 Res.

$3aac = 3 \times 19 \times 19 \times 6 = 6498$   
 $3cca = 3 \times 6 \times 6 \times 19 = 2052$   
 $ccc = 6 \times 6 \times 6 = 216$

670536 Sub.

$3aa = 3 \times 196 \times 196 = 115248$   
 $3a = 3 \times 196 = 588$

Divisor 1153068 83276161 Res.

$3aac = 3 \times 196 \times 196 \times 7 = 806736$   
 $3cca = 3 \times 7 \times 7 \times 196 = 28812$   
 $ccc = 7 \times 7 \times 7 = 343$

80962063 Sub.

2314098 Rem.

[7]

$$3aa=3 \times 1 \times 1=3 \quad 7612181.761200(196.71$$

$$3a=3 \times 1=3 \quad 1 \quad + \text{Ans.}$$

---

 Divisor 33 6612 Resolvend.
 

---

$$3aae=3 \times 1 \times 1 \times 9=27$$

$$3cca=3 \times 9 \times 9 \times 1=243$$

$$ccc=9 \times 9 \times 9=729$$

---

 5859 Subtrahend.
 

---

$$3aa=3 \times 19 \times 19=1083$$

$$3a=3 \times 19=57$$

---

 Divisor 10887 753181 Res.
 

---

$$3aae=3 \times 19 \times 19 \times 6=6498$$

$$3cca=3 \times 6 \times 6 \times 19=2052$$

$$ccc=6 \times 6 \times 6=216$$

---

 670536 Sub.
 

---

$$3aa=3 \times 196 \times 196=115248$$

$$3a=3 \times 196=588$$

---

 Divisor 1153068 82645761 Res.
 

---

$$3aae=3 \times 196 \times 196 \times 7=806736$$

$$3cca=3 \times 7 \times 7 \times 196=28812$$

$$ccc=7 \times 7 \times 7=343$$

---

 80962063 Sub.
 

---

$$3aa=3 \times 1967 \times 1967=11607267$$

$$3a=3 \times 1967=5901$$

---

 Divisor 116078571 1683698200 Res.
 

---

$$3aae=3 \times 1967 \times 1967 \times 1=11607267$$

$$3cca=3 \times 1 \times 1 \times 1967=5901$$

$$ccc=1 \times 1 \times 1=1$$

---

 1160785711 Sub.
 

---



---

 522912489 Rem.
 

---



[8]

$$3aa = 3 \times 3 \times 3 = 27 \quad 61218.001210(39.41 +$$

$$3a = 3 \times 3 = 9 \quad 27 \quad \text{Ans.}$$

---

 Divisor 279 34218 Resolvend.
 

---

$$3aae = 3 \times 3 \times 3 \times 9 = 243$$

$$3cca = 3 \times 9 \times 9 \times 3 = 729$$

$$ccc = 9 \times 9 \times 9 = 729$$

---

 32319 Subtrahend.
 

---

$$3aa = 3 \times 39 \times 39 = 4563$$

$$3a = 3 \times 39 = 117$$

---

 Divisor 45747 1899001 Res.
 

---

$$3aae = 3 \times 39 \times 39 \times 4 = 18252$$

$$3cca = 3 \times 4 \times 4 \times 39 = 1872$$

$$ccc = 4 \times 4 \times 4 = 64$$

---

 1843984 Sub.
 

---

$$3aa = 3 \times 394 \times 394 = 465708$$

$$3a = 3 \times 394 = 1182$$

---

 Divisor 4658262 55017210 Res.
 

---

$$3aae = 3 \times 394 \times 394 \times 1 = 465708$$

$$3cca = 3 \times 1 \times 1 \times 394 = 1182$$

$$ccc = 1 \times 1 \times 1 = 1$$

---

 46582621 Sub.
 

---



---

 8434589 Rem.
 

---

[9]

$$3aa = 3 \times 1 \times 1 = 3 \quad 7121.102169800(19.238 +$$

$$3a = 3 \times 1 = 3 \quad 1 \quad \text{Ans.}$$

---

 Divisor 33 6121 Resolvend.
 

---

$$3aae = 3 \times 1 \times 1 \times 9 = 27$$

$$3cca = 3 \times 9 \times 9 \times 1 = 243$$

$$ccc = 9 \times 9 \times 9 = 729$$

---

 5859 Subtrahend.
 

---

$$3aa = 3 \times 19 \times 19 = 1083$$

$$3a = 3 \times 19 = 57$$

---

 Divisor 10887 262102 Res.
 

---

R

Divisor 10887		262102 Res.
$3aac=3 \times 19 \times 19 \times 2=$	2166	
$3cca=3 \times 2 \times 2 \times 19=$	228	
$ccc=2 \times 2 \times 2=$	8	
		218888 Sub.
$3aa=3 \times 192 \times 192=$	110592	
$3a=3 \times 192=$	576	
Divisor 1106496		43214169 Res.
$3aac=3 \times 192 \times 192 \times 3=$	331776	
$3cca=3 \times 3 \times 3 \times 192=$	5184	
$ccc=3 \times 3 \times 3=$	27	
		33229467 Sub.
$3aa=3 \times 1923 \times 1923=$	11093787	
$3a=3 \times 1923=$	5769	
Divisor 110943639		9984702800 Res.
$3aac=3 \times 1923 \times 1923 \times 8=$	88750296	
$3cca=3 \times 8 \times 8 \times 1923=$	369216	
$ccc=8 \times 8 \times 8=$	512	
		8878722272 Sub.
		1105980528 Rem.

[10]		
$3aa=3 \times 2 \times 2=$	12	12000.812161(22.89 +
$3a=3 \times 2=$	6	8 Ans.
Divisor 126		4000 Resolvend.
$3aac=3 \times 2 \times 2 \times 2=$	24	
$3cca=3 \times 2 \times 2 \times 2=$	24	
$ccc=2 \times 2 \times 2=$	8	
		2648 Subtrahend.
$3aa=3 \times 22 \times 22=$	1452	
$3a=3 \times 22=$	66	
Divisor 14586		1352812 Res.

Divisor 14586 | 1352812 Resolvend.

$$3aac = 3 \times 22 \times 22 \times 8 = 11616$$

$$3cca = 3 \times 8 \times 8 \times 22 = 4224$$

$$ccc = 8 \times 8 \times 8 = 512$$

$$3aa = 3 \times 228 \times 228 = 155952$$

$$3a = 3 \times 228 = 684$$

1204352 Sub.

Divisor 1560204

148460161 Res.

$$3aac = 3 \times 228 \times 228 \times 9 = 1403568$$

$$3cca = 3 \times 9 \times 9 \times 228 = 55404$$

$$ccc = 9 \times 9 \times 9 = 729$$

140911569 Sub.

7548592 Rem.

The two following questions are worked by the "GENERAL RULE," page 152, DILWORTH.

[11]

.121861281(.495 + Ans.

64

$$4^2 \times 3 = 4 \times 4 \times 3 = 48)578 \text{ Dividend}$$

$$49^3 = 49 \times 49 \times 49 = 117649 \text{ Subtrahend}$$

$$49^2 \times 3 = 7203)42122 \text{ Dividend}$$

$$495^3 = 121287375 \text{ Subtrahend}$$

573906 Remainder

[12]-

$$\begin{array}{r} .006976121800(.19107 + \text{Ans.}) \\ 1 \end{array}$$

$$1^3 \times 3 = 3)59 \text{ Dividend}$$

$$.19^3 = .006859 \text{ Subtrahend}$$

$$19^3 \times 3 = 1083)1171 \text{ Div.}$$

$$.191^3 = .006967871 \text{ Sub.}$$

$$191^3 \times 3 = 109443)82508 \text{ Div.}$$

$$.1910^3 = .006967871000 \text{ Sub.}$$

$$1910^3 \times 3 = 10944300)82508000 \text{ Div.}$$

$$.19107^3 = .006975534818043 \text{ Sub.}$$

$$586981957 \text{ Rem.}$$

[13]

41

41

41

164

1681

41

1681

6724

68921 Ans.

[14]

12

12

144

12

1728 Ans.

[15]

474552 (

78

7^3 = 343

78

$$7^2 \times 3 = 147)1315$$

624

546

$$78^3 = 474552$$

6084 Ans.

## CUBE ROOT OF VULGAR FRACTIONS.

$$\begin{array}{r} 352)1188(3 \\ 1056 \\ \hline \end{array}$$

[1]

$$\begin{array}{r} 132)352(2 \\ 264 \\ \hline \end{array}$$

$$\begin{array}{r} 88)132(1 \\ 88 \\ \hline \end{array}$$

$$\begin{array}{r} 44)88(2 \\ 88 \\ \hline \end{array}$$

$44)_{1188}^{\frac{352}{1188}}(\frac{8}{7}$ ; and the cube root of  $\frac{8}{7}$  is  $\frac{2}{7}$ . Ans.

$$\begin{array}{r} 1944)4608(2 \\ 3888 \\ \hline \end{array}$$

[2]

$$\begin{array}{r} 720)1944(2 \\ 1440 \\ \hline \end{array}$$

$$\begin{array}{r} 504)720(1 \\ 504 \\ \hline \end{array}$$

$$\begin{array}{r} 216)504(2 \\ 432 \\ \hline \end{array}$$

$$\begin{array}{r} 72)216(3 \\ 216 \\ \hline \end{array}$$

$72)_{4608}^{\frac{1944}{4608}}(\frac{27}{64}$ ; and the cube root of  $\frac{27}{64}$  is  $\frac{3}{4}$ . Ans.

$$\begin{array}{r} 648)3000(4 \\ 2592 \\ \hline \end{array}$$

[3]

$$\begin{array}{r} 408)648(1 \\ 408 \\ \hline \end{array}$$

$$\begin{array}{r} 240)408(1 \\ 240 \\ \hline \end{array}$$

$$\begin{array}{r} 168)240(1 \\ 168 \\ \hline \end{array}$$

$$\begin{array}{r} 72)168(2 \\ 144 \\ \hline \end{array}$$

$$\begin{array}{r} 24)72(3 \\ 72 \\ \hline \end{array}$$

$24)_{3000}^{\frac{648}{3000}}(\frac{27}{125}$ ; and the cube root of  $\frac{27}{125}$  is  $\frac{3}{5}$ . Ans.

SURDS.

[4]

$$\frac{4}{3} = .44444444 \text{ \&c. (.763 + Ans.} \\ 7^3 = 343$$

$$7^2 \times 3 = 147)1014 \text{ Dividend}$$

$$76^3 = 438976 \text{ Subtrahend}$$

$$76^2 \times 3 = 17328)54684 \text{ Div.}$$

$$763^3 = 444194947 \text{ Sub.}$$

$$249497 \text{ Rem.}$$


---

[5]

$$\frac{5}{7} = .857142857 \text{ \&c. (.949 + Ans.} \\ 9^3 = 729$$

$$9^2 \times 3 = 243)1281 \text{ Div.}$$

$$94^3 = 830584 \text{ Sub.}$$

$$94^2 \times 3 = 26508)265588 \text{ Div.}$$

$$949^3 = 854670349 \text{ Sub.}$$

$$2472508 \text{ Rem.}$$


---

[6]

$$\frac{1}{3} = .33333333 \text{ \&c. (.693 + Ans.} \\ 6^3 = 216$$

$$6^2 \times 3 = 108)1173 \text{ Div.}$$

$$69^3 = 328509 \text{ Sub.}$$

$$69^2 \times 3 = 14283)48243 \text{ Div.}$$

$$693^3 = 332812557 \text{ Sub.}$$

$$520776 \text{ Rem.}$$

## CUBE ROOT OF MIXED NUMBERS.

$$[1] \quad 578 \times 27 + 19 \quad 15625$$

$$578 \frac{19}{27} = \frac{15625}{27} = \frac{15625}{27}; \text{ and}$$

15625 (25 : also the cube root of 27 is 3, whence  
 $2^3 = 8$  the cube root of  $\frac{15625}{27}$  is  $\frac{25}{3} = 8 \frac{1}{3}$ . Ans.

$$2^3 \times 3 = 12 \overline{) 76} \text{ Div.}$$

$$25^3 = 15625 \text{ Sub.}$$

$$[2] \quad 42 \times 8 + 7 \quad 343$$

$$42 \frac{7}{8} = 42 \frac{7}{8} = \frac{343}{8} = \frac{343}{8}; \text{ and the cube root of } \frac{343}{8} \text{ is}$$

$$\frac{7}{2} = 3 \frac{1}{2}. \text{ Ans.}$$

$$[3] \quad 5 \times 125 + 104 \quad 729$$

$$5 \frac{104}{125} = \frac{729}{125} = \frac{729}{125}; \text{ and the cube root of } \frac{729}{125}$$

$$\text{is } \frac{9}{5} = 1 \frac{4}{5}. \text{ Ans.}$$

## SURDS.

$$[4] \quad 8 \frac{2}{3} = 8.166666666 \text{ \&c. } (2.013 + \text{ Ans.}$$

$$2^3 = 8$$

$$2^3 \times 3 = 12 \overline{) 1}$$

$$20^3 = 8000 \text{ Sub.}$$

$$20^2 \times 3 = 1200 \overline{) 1666} \text{ Div.}$$

$$201^3 = 8120601 \text{ Sub.}$$

$$201^2 \times 3 = 121203 \overline{) 460656} \text{ Div.}$$

$$2013^3 = 8157016197 \text{ Sub.}$$

$$9650469 \text{ Rem.}$$

$$[5] \quad 7 \frac{3}{5} = 7.600000000 (1.966 + \text{ Ans.}$$

$$1^3 = 1$$

$$1^2 \times 3 = 3 \overline{) 66} \text{ Div.}$$

$$19^3 = 6859 \text{ Sub.}$$

$$19^2 \times 3 = 1083 \overline{) 7410} \text{ Div.}$$

$$19^2 \times 3 = 1083)7410 \text{ Div.}$$

$$196^3 = 7529536 \text{ Sub.}$$

$$196^2 \times 3 = 115248)704640 \text{ Div.}$$

$$1966^3 = 7598896696 \text{ Sub.}$$

$$1103304 \text{ Rem.}$$

## BIQUADRATE ROOT.

[1]	48	[2]	96
	48		96
	<hr/>		<hr/>
	384		576
	192		864
	<hr/>		<hr/>
	2304		9216
	48		96
	<hr/>		<hr/>
	18432		55296
	9216		82944
	<hr/>		<hr/>
	110592		884736
	48		96
	<hr/>		<hr/>
	884736		5308416
	442368		7962624
	<hr/>		<hr/>
	5308416 Ans.		84934656 Ans.

[3]	. . . . .	[4]	. . . . .
2	5308416(2304(48 Ans.	9	84934656(9216(96
2	4     4   16	9	81     9   81 Ans.
	<hr/>		<hr/>
43	130   88   704	182	393   186   1116
3	129       704	2	364       1116
	<hr/>		<hr/>
4604)	18416	1841	2946
	18416	1	1841
			<hr/>
		18426	110556
			110556



[5]

$$\begin{array}{r|l}
 1 & 21743271936(147456(384 \text{ Ans.} \\
 1 & 1 \quad \quad \quad 3 \quad | \quad 9 \\
 \hline
 24 & | 117 \quad \quad \quad 68 \quad | \quad 574 \\
 4 & | 96 \quad \quad \quad 8 \quad | \quad 544 \\
 \hline
 287 & | 2143 \quad \quad \quad 764 \quad | \quad 3056 \\
 7 & | 2009 \quad \quad \quad & \quad \quad 3056 \\
 \hline
 2944 & | 13427 \\
 4 & | 11776 \\
 \hline
 29485 & | 165119 \\
 5 & | 147425 \\
 \hline
 294906 & | 1769436 \\
 & \quad \quad 1769436
 \end{array}$$

SURSOLID ROOT.

The first is worked in DILWORTH.

[2]

$$\begin{array}{r}
 48 \\
 48 \\
 \hline
 384 \\
 192 \\
 \hline
 2304 \\
 48 \\
 \hline
 18432 \\
 9216 \\
 \hline
 110592 \\
 48 \\
 \hline
 884736 \\
 442368 \\
 \hline
 5308416 \\
 48 \\
 \hline
 42467328 \\
 21233664 \\
 \hline
 254803968 \text{ Ans.}
 \end{array}$$

In the following questions the "GENERAL RULE," at page 152, of DILWORTH, is used.

[3]

$$\begin{array}{r} 8153726976(96 \text{ Ans.} \\ 9^5 = 59049 \end{array}$$

$$9^4 \times 5 = 32805)224882 \text{ Div.}$$

$$96^5 = 8153726976 \text{ Sub.}$$

[4]

$$\begin{array}{r} 254803968(48 \text{ Ans.} \\ 4^5 = 1024 \end{array}$$

$$4^4 \times 5 = 1280)15240 \text{ Div.}$$

$$48^5 = 254803968 \text{ Sub.}$$

[5]

$$\begin{array}{r} 8349416423424(384 \text{ Ans.} \\ 3^5 = 243 \end{array}$$

$$3^4 \times 5 = 405)5919 \text{ Div.}$$

$$38^5 = 79235168 \text{ Sub.}$$

$$38^4 \times 5 = 10425680)42589962 \text{ Div.}$$

$$384^5 = 8349416423424 \text{ Sub.}$$

## SQUARE CUBE ROOT.

[1]

48	5308416
48	48
384	
192	42467328
2304	21233664
48	
18432	254803968
9216	48
110592	
48	2038431744
884736	1019215872
442368	
5308416	12230590464 Ans.

[2]

$$\begin{array}{r|l}
 8 & 782757789696 \quad ( \quad 884736(96 \text{ Ans.} \\
 8 & 64 \quad 9^3 = 729 \\
 \hline
 168 & 1427 \quad 9^2 \times 3 = 243) 1557 \text{ Div.} \\
 8 & 1344 \\
 \hline
 1764 & 8357 \quad 96^3 = 884736 \text{ Sub.} \\
 4 & 7056 \\
 \hline
 17687 & 130178 \\
 7 & 123809 \\
 \hline
 176943 & 636996 \\
 3 & 530829 \\
 \hline
 1769466 & 10616796 \\
 & 10616796
 \end{array}$$

[3]

$$\begin{array}{r|l}
 1 & 12230590464 \quad ( \quad 110592(48 \text{ Ans.} \\
 1 & 1 \quad 4^3 = 64 \\
 \hline
 21 & 22 \quad 4^2 \times 3 = 48) 465 \text{ Div.} \\
 1 & 21 \\
 \hline
 2205 & 13059 \quad 110592 \text{ Sub.} \\
 5 & 11025 \\
 \hline
 22109 & 203404 \\
 9 & 193981 \\
 \hline
 221182 & 442364 \\
 & 442364
 \end{array}$$

[4]

$$\begin{array}{r|l} 5 & 3206175906594816 \quad ( \quad 56623104(384 \text{ Ans.} \\ 5 & 25 \quad \quad \quad 3^3 = 27 \end{array}$$

$$\begin{array}{r|l} 106 & 706 \\ 6 & 636 \end{array} \quad 3^3 \times 3 = 27) 296 \text{ Div.}$$

$$38^3 = 54872 \text{ Sub.}$$

$$\begin{array}{r|l} 1126 & 7017 \\ 6 & 6756 \end{array} \quad 38^3 \times 3 = 4332) 17511 \text{ Div.}$$

$$\begin{array}{r|l} 11322 & 26159 \\ 2 & 22644 \end{array} \quad 384^3 = 56623104 \text{ Sub.}$$

$$\begin{array}{r|l} 113243 & 351506 \\ 3 & 339729 \end{array}$$

$$\begin{array}{r|l} 1132461 & 1177759 \\ 1 & 1132461 \end{array}$$

$$\begin{array}{r|l} 113246204 & 452984816 \\ & 452984816 \end{array}$$

## SECOND SURSOLID ROOT.

[1]

96

84934656

96

96

576

509607936

864

764411904

9216

8153726976

96

96

55296

48922361856

82944

73383542784

884736

782757789696

96

96

5308416

4696546738176

7962624

7044820107264

84934656

75144747810816 Ans.

[2]

$$\begin{array}{r} 75144747810816(96 \text{ Ans.} \\ 97 = 4782969 \end{array}$$

$$9^6 \times 7 = 3720087)27315057 \text{ Div.}$$

$$967 = 75144747810816 \text{ Sub.}$$

[3]

$$\begin{array}{r} 587068342272(48 \text{ Ans.} \\ 47 = 16384 \end{array}$$

$$4^6 \times 7 = 28672)423228 \text{ Div.}$$

$$487 = 587068342272 \text{ Sub.}$$

[4]

$$\begin{array}{r} 1231171548132409344(384 \text{ Ans.} \\ 37 = 2187 \end{array}$$

$$3^6 \times 7 = 5103)101347 \text{ Div.}$$

$$387 = 11415582592 \text{ Sub.}$$

$$38^6 \times 7 = 21076554688)87015722212 \text{ Div.}$$

$$1231171548132409344 \text{ Sub.}$$

NOTE. Divisors in the higher roots are of very little use ; and indeed the extraction of such roots, without Logarithms, is a superfluous exercise in numbers.

SQUARE BIQUADRATE ROOT.

[A]

48	5308416
48	5308416
384	
192	31850496
2304	5308416
2304	21233664
9216	42467328
6912	15925248
4608	26542080
5308416	
	28179280429056 Ans.

[2]

$$\begin{array}{r|l}
 8 & 7213895789838336(84934656(9216(96 \text{ Ans.} \\
 8 & 64 \qquad \qquad \qquad 9 \mid 81 \qquad \qquad 9 \mid 81 \\
 \hline
 164 & 813 \qquad \qquad 182 \mid 393 \quad 186 \mid 1116 \\
 4 & 656 \qquad \qquad 2 \mid 364 \qquad \qquad 1116 \\
 \hline
 1689 & 15789 \qquad \qquad 1841 \mid 2946 \\
 9 & 15201 \qquad \qquad 1 \mid 1841 \\
 \hline
 16983 & 58857 \qquad \qquad 18426 \mid 110556 \\
 3 & 50949 \qquad \qquad \qquad 110556 \\
 \hline
 169864 & 790889 \\
 4 & 679456 \\
 \hline
 1698686 & 11143383 \\
 6 & 10192116 \\
 \hline
 16986925 & 95126783 \\
 5 & 84934625 \\
 \hline
 169869306 & 1019215836 \\
 & 1019215836
 \end{array}$$

[3]

$$\begin{array}{r|l}
 5 & 28179280429056(5308416(2304(48 \text{ Ans.} \\
 5 & 25 \qquad \qquad \qquad 2 \mid 4 \qquad \qquad 4 \mid 16 \\
 \hline
 103 & 317 \qquad \qquad 43 \mid 130 \quad 88 \mid 704 \\
 3 & 309 \qquad \qquad 3 \mid 129 \qquad \qquad 704 \\
 \hline
 10608 & 89280 \qquad \qquad 4604 \mid 18416 \\
 8 & 84864 \qquad \qquad \qquad 18416 \\
 \hline
 106164 & 441642 \\
 4 & 424656 \\
 \hline
 1061681 & 1698690 \\
 1 & 1061681 \\
 \hline
 10616826 & 63700956 \\
 & 63700956
 \end{array}$$

[4]	472769874482845188096(21743271936(147456(384	
2	4	1   1
2		3   9
		Ans.
41   72	24   117	68   574
1   41	4   96	8   544
427   3176	287   2143	764   3056
7   2989	7   2009	3056
4344   18798	2944   13427	
4   17376	4   11776	
43483   142274	29485   165119	
3   130449	5   147425	
434862   1182548	294906   1769436	
2   869724	1769436	
4348647   31282428		
7   30440529		
43486541   84189945		
1   43486541		
434865429   4070340418		
9   3913788861		
4348654383   15655155780		
3   13045963149		
43486543866   260919263196		
260919263196		

[1]

$$\begin{array}{r} 692533995824480256(884736(96 \\ 8^3 = 512 \qquad \qquad \qquad 9^3 = 729 \end{array}$$

Ans.

$$8^2 \times 3 = 192)1805 \text{ Div. } 9^2 \times 3 = 243)1557 \text{ Div.}$$

$$88^2 = 681472 \text{ Sub. } \quad 96^3 = 884736 \text{ Sub.}$$

$$88^2 \times 3 = 23232)110619 \text{ D.}$$

$$884^3 = 690807104 \text{ S.}$$

$$884^2 \times 3 = 2344368)17268918 \text{ D.}$$

$$8847^3 = 692449461423 \text{ S.}$$

$$8847^2 \times 3 = 234808227)845344014 \text{ D.}$$

$$88473^3 = 692519906279817 \text{ S.}$$

$$88473^2 \times 3 = 23482415187)139895446630 \text{ D.}$$

$$884736^3 = 692533995824480256 \text{ S.}$$

[2]

$$\begin{array}{r} 1352605460594688(110592(48 \text{ Ans.} \\ 1^3 = 1 \qquad \qquad \qquad 4^3 = 64 \end{array}$$

$$1^2 \times 3 = 3)3 \text{ Div. } 4^2 \times 3 = 48)465 \text{ D.}$$

$$11^3 = 1331 \text{ Sub. } \quad 48^3 = 110592 \text{ S.}$$

$$11^2 \times 3 = 363)216 \text{ D.}$$

$$110^3 = 1331000 \text{ S.}$$

$$110^2 \times 3 = 36300)216054 \text{ D.}$$

$$1105^3 = 1349232625 \text{ S.}$$

$$1105^2 \times 3 = 3663075)33728355 \text{ D.}$$

$$11059^3 = 1352532078379 \text{ S.}$$

$$11059^2 \times 3 = 366904443)733822156 \text{ D.}$$

$$110592^3 = 1352605460594688 \text{ S.}$$



[3]

$$\begin{array}{r} 18154363180141255228864(56623104)384 \\ 3^3=125 \quad \quad \quad 3^3=27 \quad \text{Ans.} \end{array}$$

$$5^2 \times 3 = 75) 565 \text{ Div.} \quad 3^2 \times 3 = 27) 296 \text{ Div.}$$

$$56^3 = 175616 \text{ Sub.} \quad 38^3 = 54872 \text{ Sub.}$$

$$56^2 \times 3 = 9408) 59276 \text{ D.} \quad 38^2 \times 3 = 4332) 17511 \text{ D.}$$

$$566^3 = 181321496 \text{ S.} \quad 384^3 = 56623104 \text{ S.}$$

$$566^2 \times 3 = 961068) 2221358 \text{ D.}$$

$$5662^3 = 181513777528 \text{ S.}$$

$$5662^2 \times 3 = 96174732) 298542734 \text{ D.}$$

$$56623^3 = 181542631476367 \text{ S.}$$

$$56623^2 \times 3 = 9618492387) 10003250455 \text{ D.}$$

$$566231^3 = 181543593327304391 \text{ S.}$$

$$566231^2 \times 3 = 961852636083) 384741081612 \text{ D.}$$

$$5662310^3 = 181543593327304391000 \text{ S.}$$

$$5662310^2 \times 3 = 96185263608300) 384741081612288 \text{ D.}$$

$$56623104^3 = 18154363180141255228864 \text{ S.}$$

## SQUARE SURSOLID ROOT.

[1]  $\begin{array}{r|l} 2 & 64925062108545024(254803968(48 \text{ Ans.} \\ 2 & 4 \qquad \qquad \qquad 4^5 = 1024 \\ \hline 45 & 249 \qquad 4^4 \times 5 = 1280) \overline{15240} \text{ D.} \\ 5 & 225 \qquad \qquad \qquad 48^5 = 254803968 \text{ S.} \\ \hline 504 & 2425 \\ 4 & 2016 \\ \hline 5088 & 40906 \\ 8 & 40704 \\ \hline 509603 & 2022108 \\ 3 & 1528809 \\ \hline 5096069 & 49329954 \\ 9 & 45864621 \\ \hline 50960786 & 346533350 \\ 6 & 305764716 \\ \hline 509607928 & 4076863424 \\ & 4076863424 \end{array}$

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[2]  $\begin{array}{r|l} 8 & 66483263599150104576(8153726976(96 \text{ Ans.} \\ 8 & 64 \qquad \qquad \qquad 9^5 = 59049 \\ \hline 161 & 248 \qquad 9^4 \times 5 = 32805) \overline{224882} \text{ D.} \\ 1 & 161 \qquad \qquad \qquad 96^5 = 8153726976 \\ \hline 1625 & 8732 \\ 5 & 8125 \\ \hline 16303 & 60763 \\ 3 & 48909 \\ \hline 163067 & 1185459 \\ 7 & 1141469 \\ \hline 1630742 & 4399091 \\ 2 & 3261484 \\ \hline 16307446 & 113760750 \\ 6 & 97844676 \\ \hline 163074529 & 1591607410 \\ 9 & 1467670761 \\ \hline 1630745387 & 12393664945 \\ 7 & 11415217709 \\ \hline 16307453946 & 97844723676 \\ & 97844723676 \end{array}$

[3]

8	69712754611742420055883776(8349416423424(384	Ans.
8	64	$3^5 = 243$
163	571	$3^4 \times 5 = 405)5919$ Div.
3	489	$38^5 = 79235168$ Sub.
1664	8227	$38^4 \times 5 = 10425680)42589962$ D.
4	6656	$384^5 = 8349416423424$ S.
16689	157154	
9	150201	
166984	695361	
4	667936	
1669881	2742517	
1	1669881	
16698826	107263642	
6	100192956	
166988324	707068642	
4	667953296	
1669883282	3911534600	
2	3339766564	
16698832843	57176803655	
3	50096498529	
166988328464	708030512688	
4	667953313856	
1669883284682	4007719883227	
2	3339766569364	
16698832846844	66795331387376	
	66795331387376	

## THIRD SURSOLID ROOT.

[1]

$952809757913927(23$  Ans.

$2^{11} = 2048$

$2^{10} \times 11 = 11264)74800$  D.

$23^{11} = 952809757913927$  S.

[2]

$3116402981210161152(48$  Ans.

$4^{11} = 4194304$

$4^{10} \times 11 = 11534346)269697258$  D.

$48^{11} = 3116402981210161152$  S.

# 212 SQUARED SQUARE CUBE ROOT.

[3]

$$6382393305518410039296 \text{ (96 Ans.)}$$

$$9^{11} = 31381039609$$

$$9^{10} \times 11 = 38354628411)324428734491 \text{ D.}$$

$$96^{11} = 6382393305518410039296 \text{ S.}$$

## SQUARED SQUARE CUBE ROOT.

[1]  $1 \mid 149587343098087735296(12230590464 \text{ ( } 110592(48$   
 $1 \mid 1 \quad 1 \mid 1 \quad 4^3 = 64 \text{ Ans.}$

$$\begin{array}{r|l} 22 & 49 \\ 2 & 44 \end{array}$$

$$\begin{array}{r|l} 21 & 22 \\ 1 & 21 \end{array} \quad 4^2 \times 3 = 48)465 \text{ D.}$$

$$\begin{array}{r|l} 242 & 558 \\ 2 & 484 \end{array}$$

$$48^3 = 110592 \text{ S.}$$

$$\begin{array}{r|l} 2205 & 13059 \\ 5 & 11025 \end{array}$$

$$\begin{array}{r|l} 2443 & 7473 \\ 3 & 7329 \end{array}$$

$$\begin{array}{r|l} 22109 & 203404 \\ 9 & 198981 \end{array}$$

$$\begin{array}{r|l} 244605 & 1444309 \\ 5 & 1223025 \end{array}$$

$$\begin{array}{r|l} 221182 & 442364 \\ & 442364 \end{array}$$

$$\begin{array}{r|l} 2446109 & 22128480 \\ 9 & 22014981 \end{array}$$

$$\begin{array}{r|l} 244611804 & 1134998773 \\ 4 & 978447216 \end{array}$$

$$\begin{array}{r|l} 2446118086 & 15655155752 \\ 6 & 14676708516 \end{array}$$

$$\begin{array}{r|l} 24461180924 & 97844723696 \\ & 97844723696 \end{array}$$

$$[2] \quad \begin{array}{r|l} 7 & 612709757329767363772416(782757789696 \quad (884736(96 \\ 7 & 49 \quad \quad \quad \frac{8}{8} \mid 64 \quad \quad \quad 9^3=729 \end{array} \quad \text{Ans.}$$

$$\begin{array}{r|l} 148 & 1227 \\ 8 & 1184 \end{array} \quad \begin{array}{r|l} 168 & 1427 \quad 9^2 \times 3 = 243 \quad 1557 \text{ D.} \\ 8 & 1344 \end{array}$$

$$96^3 = 884736 \text{ S.}$$

$$\begin{array}{r|l} 1562 & 4309 \\ 2 & 3124 \end{array} \quad \begin{array}{r|l} 1764 & 8357 \\ 4 & 7056 \end{array}$$

$$\begin{array}{r|l} 15647 & 118575 \\ 7 & 109529 \end{array} \quad \begin{array}{r|l} 17687 & 130178 \\ 7 & 123809 \end{array}$$

$$\begin{array}{r|l} 156545 & 904673 \\ 5 & 782725 \end{array} \quad \begin{array}{r|l} 176943 & 636996 \\ 3 & 530829 \end{array}$$

$$\begin{array}{r|l} 1565507 & 12194829 \\ 7 & 10958549 \end{array} \quad \begin{array}{r|l} 1769466 & 10616796 \\ & 10616796 \end{array}$$

$$\begin{array}{r|l} 15655147 & 123628076 \\ 7 & 109586029 \end{array}$$

$$\begin{array}{r|l} 156551548 & 1404204773 \\ 8 & 1252412384 \end{array}$$

$$\begin{array}{r|l} 1565515569 & 15179238963 \\ 9 & 14089640121 \end{array}$$

$$\begin{array}{r|l} 15655155786 & 108959884277 \\ 6 & 93930934716 \end{array}$$

$$\begin{array}{r|l} 156551557929 & 1502894956124 \\ 9 & 1408964021361 \end{array}$$

$$\begin{array}{r|l} 1565515579386 & 9393093476316 \\ & 9393093476316 \end{array}$$

[3]

3 | 10279563944029090291760398073856(3206175906594816 ( 56623104(384  
 3 | 9

Ans.

62 | 127  
 2 | 124

6406 | 39563  
 6 | 38436

64121 | 112794  
 1 | 64121

641227 | 4867340  
 7 | 4488589

6412345 | 37873129  
 5 | 32061725

64123509 | 581340409  
 9 | 577111581

6412351806 | 42288280291  
 6 | 38474110836

64123518125 | 381416945376  
 5 | 320617590625

641235181309 | 6079935495103  
 9 | 5771116631781

6412351813184 | 30881886332298  
 4 | 25649407252736

64123518131888 | 523247907956207  
 8 | 512988145055104

641235181318961 | 1023976290110338  
 1 | 641235181318961

6412351813189626 | 38474110879137756  
 38474110879137756

3 | 25

106 | 706  
 6 | 636

32 X 3 = 27(296 Div.

383 = 54872 Sub.

1126 | 7017  
 6 | 6756

382 X 3 = 4332(17511 D.

3843 = 56623104 S.

11322 | 26159  
 2 | 22644

113243 | 351506  
 3 | 339729

1132461 | 1177759  
 1 | 1132461

113246204 | 452984816  
 452984816

## SIMPLE INTEREST.

## Case 1.

$$[1] \quad ptr + p = 567.5 \times 9 \times .06 + 567.5 = 306.45 + 567.5 \\ = 873.95 = 873\frac{19}{20} \text{ Ans.}$$

$$\begin{array}{r} \text{---} \\ 5107.5 \\ .06 \\ \text{---} \\ 306.450 \\ 567.5 \\ \text{---} \\ 873.950 \\ 20 \\ \text{---} \\ 19.000 \end{array}$$

NOTE. It would be superfluous to give the reductions in decimals, at length, as the learner must be supposed already acquainted with them.

$$[2] \quad ptr + p = 508.7 \times 1 \times .05 + 508.7 = 25.435 + 508.7 \\ = \pounds.534.135 = \pounds.534 \ 2 \ 8\frac{1}{4}.6 \text{ Ans.}$$

$$[3] \quad ptr + p = 600.7 \times 10 \times .045 + 600.7 = 270.315 + 600.7 \\ = 871.015 = \pounds.871 \ 0 \ 3\frac{1}{2}.4 \text{ Ans.}$$

$$[4] \quad ptr + p = 4000 \times 5 \times .035 + 4000 = 700 + 4000 = \pounds.4700 \text{ Ans.}$$

$$[5] \quad ptr + p = 7200 \times 6.5 \times .05 + 7200 = 2340 + 7200 \\ = \pounds.9540 \text{ Ans.}$$

$$[6] \quad ptr + p = 1110.9 \times 12.75 \times .05 + 1110.9 = 708.19875 \\ + 1110.9 = 1819.09875 = \pounds.1819 \ 1 \ 11\frac{1}{2}.8 \text{ Ans.}$$

By the Table.\*

[7]

$$100 = .273973$$

$$40 = .109589$$

$$8 = .021918$$

$$ptr + p = 280.5 \times 3.40548 \times .05 + 280.5$$

280.5

1702740

2724384

681096

955.23714

.05

47.7618570

280.5

328.261857

20

5.237140

Ans. 328l. 5 2 $\frac{1}{4}$ .384

12

2.84568

4

3.38272

[8]

By the Table.

$$100 = .273973$$

$$80 = .219178$$

$$9 = .024658$$

$$ptr + p = 196 \times .517809 \times .04 + 196 = 4.05962256 + 196 = 200.05962256 = \text{£. } 200 \text{ } 1 \text{ } 2\frac{1}{4} \text{ } .23 + \text{Ans.}$$

\* NOTE. By reducing the mixed fraction  $3\frac{148}{367}$  to a decimal, it will be seen how the table is made.

Case 2.

$$[1] \quad \frac{a}{tr+1} = \frac{873.95}{9 \times .06 + 1} = \frac{873.95}{1.54} = 567.5 = \text{£. } 567 \text{ } 10s. \text{ Ans.}$$



$$\begin{array}{r|l} 4 & 1.6 \\ 12 & 8.4 \\ 20 & 2.7 \end{array} \quad [2]$$

$$\begin{array}{r} a \\ \hline \end{array} \quad \begin{array}{r} 534.135 \\ \hline \end{array} \quad \begin{array}{r} 534.135 \\ \hline \end{array} = 508.7 = £508 \text{ 14s. } \text{Ans.} \\ \hline \begin{array}{r} tr+1 \\ \hline \end{array} \quad \begin{array}{r} 1 \times .05 + 1 \\ \hline \end{array} \quad \begin{array}{r} 1.05 \\ \hline \end{array}$$

$$[3] \quad \begin{array}{r} a \\ \hline \end{array} \quad \begin{array}{r} 9540 \\ \hline \end{array} \quad \begin{array}{r} 9540 \\ \hline \end{array} = £7200. \text{ Ans.} \\ \hline \begin{array}{r} tr+1 \\ \hline \end{array} \quad \begin{array}{r} 6.5 \times .05 + 1 \\ \hline \end{array} \quad \begin{array}{r} 1.325 \\ \hline \end{array}$$

$$\begin{array}{r|l} 4 & 2.8 \\ 12 & 11.7 \\ 20 & 1.975 \end{array} \quad [4]$$

$$\begin{array}{r} a \\ \hline \end{array} \quad \begin{array}{r} 1819.09875 \\ \hline \end{array} \quad \begin{array}{r} 1819.09875 \\ \hline \end{array} = £1110.9 = \\ \hline \begin{array}{r} tr+1 \\ \hline \end{array} \quad \begin{array}{r} 12.75 \times .05 + 1 \\ \hline \end{array} \quad \begin{array}{r} 1.6375 \\ \hline \end{array} \quad £1110 \text{ 18s. } \text{Ans.}$$

$$\begin{array}{r|l} 4 & 2.4 \\ 12 & 3.6 \\ 20 & 0.30 \end{array} \quad [5]$$

$$\begin{array}{r} a \\ \hline \end{array} \quad \begin{array}{r} 871.015 \\ \hline \end{array} \quad \begin{array}{r} 871.015 \\ \hline \end{array} = £600.7 = £600 \text{ 14s. } \\ \hline \begin{array}{r} tr+1 \\ \hline \end{array} \quad \begin{array}{r} 10 \times .045 + 1 \\ \hline \end{array} \quad \begin{array}{r} 1.45 \\ \hline \end{array} \quad \text{Ans.}$$

$$[6] \quad \begin{array}{r} a \\ \hline \end{array} \quad \begin{array}{r} 4700 \\ \hline \end{array} \quad \begin{array}{r} 4700 \\ \hline \end{array} = £4000. \text{ Ans.} \\ \hline \begin{array}{r} tr+1 \\ \hline \end{array} \quad \begin{array}{r} 5 \times .035 + 1 \\ \hline \end{array} \quad \begin{array}{r} 1.175 \\ \hline \end{array}$$

$$\begin{array}{r|l} 4 & 3.38 \\ 12 & 2.84 \\ 20 & 5.23 \end{array} \quad [7]$$

$$\begin{array}{r} a \\ \hline \end{array} \quad \begin{array}{r} 328.26 \text{ &c.} \\ \hline \end{array} \quad \begin{array}{r} 328.26 \text{ &c.} \\ \hline \end{array} = £280.5 = \\ \hline \begin{array}{r} tr+1 \\ \hline \end{array} \quad \begin{array}{r} 3.405 \text{ &c.} \times .05 + 1 \\ \hline \end{array} \quad \begin{array}{r} 1.17025 \text{ &c.} \\ \hline \end{array} \quad £280 \text{ 10s. } \text{Ans.}$$

$$\begin{array}{r|l} 4 & 2. \\ 12 & 2.5 \\ 20 & 1.2 \end{array} \quad [8]$$

$$\begin{array}{r} a \\ \hline \end{array} \quad \begin{array}{r} 200.06 \text{ &c.} \\ \hline \end{array} \quad \begin{array}{r} 200.06 \text{ &c.} \\ \hline \end{array} = £196. \text{ Ans.} \\ \hline \begin{array}{r} tr+1 \\ \hline \end{array} \quad \begin{array}{r} .51 \text{ &c.} \times .04 + 1 \\ \hline \end{array} \quad \begin{array}{r} 1.0204 \text{ &c.} \\ \hline \end{array}$$

\* From the 7th & 8th examples in the 1st Case, it will be seen how these numbers were formed; and, as there were decimal remainders, the answers will not be obtained exactly.

## Case 3.

$$[1] \quad \frac{a-p}{tp} = \frac{873.95-567.5}{9 \times 567.5} = \frac{306.45}{5107.5} = .06, \text{ or } 6 \text{ per cent. Ans.}$$

$$[2] \quad \frac{a-p}{tp} = \frac{534.135-508.7}{1 \times 508.7} = \frac{25.435}{508.7} = .05, \text{ or } 5 \text{ per ct. Ans.}$$

$$[3] \quad \frac{a-p}{tp} = \frac{9540-7200}{6.5 \times 7200} = \frac{2340}{46800} = .05, \text{ or } 5 \text{ per ct. Ans.}$$

$$[4] \quad \frac{a-p}{tp} = \frac{1819.09875-1110.9}{12.75 \times 1110.9} = \frac{708.19875}{14163.975} = .05, \text{ or } 5 \text{ per cent. Ans.}$$

$$[5] \quad \frac{a-p}{tp} = \frac{871.015-600.7}{10 \times 600.7} = \frac{270.315}{6007} = .045, \text{ or } 4\frac{1}{2} \text{ per cent. Ans.}$$

$$[6] \quad \frac{a-p}{tp} = \frac{4700-4000}{5 \times 4000} = \frac{700}{20000} = .035, \text{ or } 3\frac{1}{2} \text{ p. ct. Ans.}$$

$$[7] \quad \frac{a-p}{tp} = \frac{328.26\&c.-289.5}{3.405\&c. \times 280.5} = \frac{47.76\&c.}{955.237\&c.} = .05, \text{ or } 5 \text{ per cent. Ans.}$$

$$[8] \quad \frac{a-p}{tp} = \frac{200.0596 \&c.-196}{.5178\&c. \times 196} = \frac{4.0596 \&c.}{101.48 \&c.} = .04, \text{ or } 4 \text{ per cent. Ans.}$$

\* In Case 1, the manner of reducing to decimals is shewn for all the examples in this case.

## Case 4.

For reducing the decimals see the 1st case.

$$[1] \quad \frac{a-p}{rp} = \frac{873.95-567.5}{.06 \times 567.5} = \frac{306.45}{34.05} = 9 \text{ years. Ans.}$$

$$[2] \quad \frac{a-p}{rp} = \frac{534.135-508.7}{.05 \times 508.7} = \frac{25.435}{25.435} = 1 \text{ year. Ans.}$$

$$[3] \quad \frac{a-p}{r \cdot p} = \frac{9540-7200}{.05 \times 7200} = \frac{2340}{360} = 6.5 = 6\frac{1}{2} \text{ years. Ans.}$$

$$[4] \quad \frac{a-p}{r \cdot p} = \frac{1819.09875-1110.9}{.05 \times 1110.9} = \frac{708.19875}{55.545} = 12.75 = 12\frac{3}{4} \text{ [yrs. Ans.]}$$

$$[5] \quad \frac{a-p}{r \cdot p} = \frac{871.015-600.7}{.045 \times 600.7} = \frac{270.315}{27.0315} = 10 \text{ years. Ans.}$$

$$[6] \quad \frac{a-p}{r \cdot p} = \frac{4700-4000}{.035 \times 4000} = \frac{700}{140} = 5 \text{ years. Ans.}$$

$$[7] \quad \frac{a-p}{r \cdot p} = \frac{328.26\&c.-280.5}{.05 \times 280.5} = \frac{47.76 \&c.}{14.025} = 3.405\&c. = 3 \text{ yrs. 148 days. Ans.}$$

$$[8] \quad \frac{a-p}{r \cdot p} = \frac{200.0596 \&c.-196}{.04 \times 196} = \frac{4.0596\&c.}{7.84} = .5178\&c. \text{ yr. 189 days. Ans.}$$

## ANNUITIES, OR PENSIONS IN ARREARS.

Case 1.

$$[1] \quad \frac{tut-tu}{2} \times r + tu = \frac{5 \times 70 \times 5 - 5 \times 70}{2} \times .05 + \frac{5 \times 70}{2} = 1750 - 350 = 1400$$

$$\frac{1400}{2} \times .05 + 350 = \frac{1400}{2} \times .05 + 350 = 700 \times .05 + 350 = 35 + 350 = 385. \text{ Ans.}$$

$$[2] \quad \frac{tut-tu}{2} \times r + tu = \frac{7 \times 56 \times 7 - 7 \times 56}{2} \times .06 + \frac{7 \times 56}{2} = 2744 - 392 = 2352$$

$$\frac{2352}{2} \times .06 + 392 = \frac{2352}{2} \times .06 + 392 = 1176 \times .06 + 392 = 70.56 + 392 = 462.56 = 462 \text{ 11 24.6 Ans.}$$

$$\begin{aligned}
 [3] \quad & \frac{tut-tu}{2} \times r + tu = \frac{7 \times 50 \times 7 - 7 \times 50}{2} \times .04 + 7 \times 50 = \\
 & \frac{2450-350}{2} \times .04 + 350 = \frac{2100}{2} \times .04 + 350 = 1050 \times .04 + 350 \\
 & = 42 + 350 = \text{£}392. \quad \text{Ans.}
 \end{aligned}$$


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$$\begin{aligned}
 [4] \quad & \frac{tut-tu}{2} \times r + tu = \frac{7 \times 100 \times 7 - 7 \times 100}{2} \times .045 + 7 \times 100 \\
 & = \frac{4900-700}{2} \times .045 + 700 = \frac{4200}{2} \times .045 + 700 = 2100 \times \\
 & .045 + 700 = 94.5 + 700 = 794.5 = \text{£}794 \text{ } 10s. \quad \text{Ans.}
 \end{aligned}$$


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$$\begin{aligned}
 [5] \quad & \frac{tut-tu}{2} \times r + tu = \frac{10 \times 35 \times 10 - 10 \times 35}{2} \times .025 + 10 \times 35 \\
 & = \frac{3500-350}{2} \times .025 + 350 = \frac{3150}{2} \times .025 + 350 = 1575 \times .025 + \\
 & 350 = 39.375 + 350 = 389.375 = \text{£}389 \text{ } 7 \text{ } 6. \quad \text{Ans.}
 \end{aligned}$$


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$$\begin{aligned}
 [6] \quad & \frac{tut-tu}{2} \times r + tu = \frac{20 \times 17.5 \times 20 - 20 \times 17.5}{2} \times .0125 \\
 & + 20 \times 17.5 = \frac{7000-350}{2} \times .0125 + 350 = \frac{6650}{2} \times .0125 \\
 & + 350 = 3325 \times .0125 + 350 = 41.5625 + 350 = \text{£}391.5625 \\
 & = \text{£}391 \text{ } 11 \text{ } 3. \quad \text{Ans.}
 \end{aligned}$$


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## Case 2.

$$\begin{aligned}
 [1] \quad & \frac{2a}{trt-tr+2t} = \frac{2 \times 385}{5 \times .05 \times 5 - 5 \times .05 + 2 \times 5} = \\
 & \frac{770}{1.25-.25+10} = \frac{770}{11} = \text{£}70. \quad \text{Ans.}
 \end{aligned}$$

$$\begin{array}{rcl}
 [2] & \frac{2a}{trt-tr+2t} = \frac{2 \times 462.56}{7 \times .06 \times 7 - 7 \times .06 + 2 \times 7} = & \\
 & \frac{925.12}{925.12} = & \\
 & \frac{2.94-.42+14}{16.52} = \frac{12.52}{16.52} = & \text{£ } 56. \text{ Ans.}
 \end{array}$$

$$\begin{array}{rcl}
 [3] & \frac{2a}{trt-tr+2t} = \frac{2 \times 392}{7 \times .04 \times 7 - 7 \times .04 + 2 \times 7} = & \\
 & \frac{784}{784} = & \\
 & \frac{1.96-.28+14}{15.68} = \frac{14.68}{15.68} = & \text{£ } 50. \text{ Ans.}
 \end{array}$$

$$\begin{array}{rcl}
 [4] & \frac{2a}{trt-tr+2t} = \frac{2 \times 794.5}{7 \times .045 \times 7 - 7 \times .045 + 2 \times 7} = & \\
 & \frac{1589}{1589} = & \\
 & \frac{2.205-.315+14}{15.89} = \frac{14.885}{15.89} = & \text{£ } 100. \text{ Ans.}
 \end{array}$$

$$\begin{array}{rcl}
 [5] & \frac{2a}{trt-tr+2t} = \frac{2 \times 389.375}{10 \times .025 \times 10 - 10 \times .025 + 2 \times 10} = & \\
 & \frac{778.75}{778.75} = & \\
 & \frac{2.5-.25+20}{22.25} = \frac{20}{22.25} = 35; \text{ and } \text{£ } 35 \times 2 = \text{£ } 70. \text{ Ans.}
 \end{array}$$

$$\begin{array}{rcl}
 [6] & \frac{2a}{trt-tr+2t} = \frac{2 \times 391.5625}{20 \times .0125 \times 20 - 20 \times .0125 + 2 \times 20} = & \\
 & \frac{783.125}{783.125} = & \\
 & \frac{5-.25+40}{44.75} = \frac{40}{44.75} = 17.5 \text{ and } \text{£ } 17.5 \times 4 = \text{£ } 70. \text{ Ans.}
 \end{array}$$

Case 3.

$$\begin{array}{rcl}
 [1] & \frac{2a-2ut}{utt-ut} = \frac{2 \times 385 - 2 \times 70 \times 5}{70 \times 5 \times 5 - 70 \times 5} = \frac{770-700}{1750-350} = \frac{70}{1400} = & \\
 & = .05, \text{ or } 5 \text{ per cent. } \text{Ans.}
 \end{array}$$

$$\begin{aligned}
 [2] \quad & \frac{2a-2ut}{utt-ut} = \frac{2 \times 462.56 - 2 \times 56 \times 7}{56 \times 7 \times 7 - 56 \times 7} = \frac{925.12 - 784}{2744 - 392} \\
 & = \frac{141.12}{2352} = .06, \text{ or } 6 \text{ per cent. Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [3] \quad & \frac{2a-2ut}{utt-ut} = \frac{2 \times 392 - 2 \times 50 \times 7}{50 \times 7 \times 7 - 50 \times 7} = \frac{784 - 700}{2450 - 350} \\
 & = \frac{84}{2100} = .04, \text{ or } 4 \text{ per cent. Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [4] \quad & \frac{2a-2ut}{utt-ut} = \frac{2 \times 794.5 - 2 \times 100 \times 7}{100 \times 7 \times 7 - 100 \times 7} = \frac{1589 - 1400}{4900 - 700} \\
 & = \frac{189}{4200} = .045, \text{ or } 4\frac{1}{2} \text{ per cent. Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [5] \quad & \frac{2a-2ut}{utt-ut} = \frac{2 \times 389.375 - 2 \times 35 \times 10}{35 \times 10 \times 10 - 10 \times 35} = \frac{778.75 - 700}{3500 - 350} \\
 & = \frac{78.75}{3150} = .025; \text{ and } .025 \times 2 = .05, \text{ or } 5 \text{ per cent. Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [6] \quad & \frac{2a-2ut}{utt-ut} = \frac{2 \times 301.5625 - 2 \times 17.5 \times 20}{17.5 \times 20 \times 20 - 17.5 \times 20} = \frac{783.125 - 700}{7000 - 350} \\
 & = \frac{83.125}{6650} = .0125; \text{ and } .0125 \times 4 = .05, \text{ or } 5 \text{ per cent. Ans.}
 \end{aligned}$$

Case 4.

$$[1] \quad \frac{2}{r} - 1 = \frac{2}{.05} - 1 = 40 - 1 = 39 = x; \text{ and}$$

$$\sqrt{\frac{2a}{ru} + \frac{xx}{4} - \frac{1}{2}x} = \sqrt{\frac{2 \times 385}{.05 \times 70} + \frac{39 \times 39}{4} - \frac{1}{2} \times 39} = \sqrt{\frac{770}{3.5} + \frac{1521}{4}}$$

$$= 19.5 = \sqrt{220 + 380.25} = 19.5 = \sqrt{600.25} = 19.5 = 24.5$$

$$= 19.5 = 5 \text{ years. Ans.}$$

$$[2] \quad \frac{2}{r} - 1 = \frac{2}{.06} - 1 = 33\frac{1}{3} - 1 = 32\frac{1}{3} = \frac{97}{3} = x;$$

$$\text{and } \sqrt{\frac{2a}{ru} + \frac{xx}{4} - \frac{1}{2}x} = \sqrt{\frac{2 \times 462.56}{.06 \times 56} + \frac{97}{3} \times \frac{97}{3} - \frac{1}{2} \times \frac{97}{3}}$$

$$= \sqrt{\frac{925.12}{3.36} + \frac{9409}{36} - \frac{97}{6}} = \sqrt{275\frac{1}{3} + \frac{9409}{36} - \frac{97}{6}} = \sqrt{\frac{826}{3} + \frac{9409}{36}}$$

$$= \frac{97}{6} = \sqrt{\frac{9912}{36} + \frac{9409}{36} - \frac{97}{6}} = \sqrt{\frac{19321}{36} - \frac{97}{6}} = \sqrt{\frac{139}{6} - \frac{97}{6}}$$

$$= \frac{42}{6} = 7 \text{ years. Ans.}$$

$$[3] \quad \frac{2}{r} - 1 = \frac{2}{.04} - 1 = 50 - 1 = 49 = x; \text{ and}$$

$$\sqrt{\frac{2a}{ru} + \frac{xx}{4} - \frac{1}{2}x} = \sqrt{\frac{2 \times 392}{.04 \times 50} + \frac{49 \times 49}{4} - \frac{1}{2} \times 49}$$

$$= \sqrt{\frac{784}{2} + \frac{2401}{4} - \frac{49}{2}} = \sqrt{\frac{1568}{4} + \frac{2401}{4} - \frac{49}{2}} = \sqrt{\frac{3969}{4}}$$

$$= \frac{49}{2} = \frac{63}{2} - \frac{49}{2} = \frac{14}{2} = 7 \text{ years. Ans.}$$

$$[4] \quad \frac{2}{r} - 1 = \frac{2}{.045} - 1 = \frac{2000}{45} - 1 = \frac{400}{9} - 1 =$$

$$44\frac{4}{9} - 1 = 43\frac{4}{9} = \frac{391}{9} = x; \text{ and } \sqrt{\frac{2a}{ru} + \frac{xx}{4}} - \frac{1}{2}x =$$

$$\sqrt{\frac{2 \times 794.5}{.045 \times 100} + \frac{391 \times 391}{9 \times 9 \times 4}} - \frac{1}{2} \times \frac{391}{9} = \sqrt{\frac{1589}{4.5} + \frac{152881}{324}}$$

$$+ \frac{391}{18} = \sqrt{\frac{15890}{45} + \frac{152881}{324}} - \frac{391}{18} = \sqrt{\frac{3178}{9} + \frac{152881}{324}}$$

$$- \frac{391}{18} = \sqrt{\frac{114408}{324} + \frac{152881}{324}} - \frac{391}{18} = \sqrt{\frac{267289}{324}} - \frac{391}{18}$$

$$= \frac{517}{18} - \frac{391}{18} = \frac{126}{18} = 7 \text{ years. Ans.}$$

$$[5] \quad \frac{2}{r} - 1 = \frac{2}{.025} - 1 = 80 - 1 = 79 = x;$$

$$\text{and } \sqrt{\frac{2a}{ru} + \frac{xx}{4}} - \frac{1}{2}x = \sqrt{\frac{2 \times 389.375}{.025 \times 35} + \frac{6241}{4}} - \frac{1}{2} \times 79$$

$$= \sqrt{\frac{778.75}{.875} + \frac{6241}{4}} - \frac{79}{2} = \sqrt{890 + \frac{6241}{4}} - \frac{79}{2} =$$

$$\sqrt{\frac{9801}{4}} - \frac{79}{2} = \frac{99}{2} - \frac{79}{2} = \frac{20}{2} = 10 \text{ payments} = 5 \text{ years. Ans.}$$



$$[6] \quad \frac{2}{r} - 1 = \frac{2}{.0125} - 1 = 160 - 1 = 159 = x;$$

$$\text{and } \sqrt{\frac{2a}{ru}} + \frac{xx}{4} - \frac{1}{2}x = \sqrt{\frac{2 \times 391.5625}{.0125 \times 17.5}} + \frac{159 \times 159}{4} - \frac{1}{2}$$

$$\times 159 = \sqrt{\frac{783.125}{.21875} + \frac{25281}{4} - \frac{159}{2}} = \sqrt{3580 + \frac{25281}{4}}$$

$$- \frac{159}{2} = \sqrt{\frac{39601}{4} - \frac{159}{2}} = \frac{199}{2} - \frac{159}{2} = \frac{40}{2} = 20$$

payments = 5 years. Ans.

## PRESENT WORTH OF ANNUITIES, PENSIONS, &c.

Case 1.

$$[1] \quad \frac{rtt - rt + 2t}{2rt + 2} \times u = \frac{.05 \times 6 \times 6 - .05 \times 6 + 2 \times 6}{2 \times .05 \times 6 + 2} \times 50 =$$

$$\frac{1.8 - .3 + 12}{.6 + 2} \times 50 = \frac{13.5}{2.6} \times 50 = \frac{675}{2.6} = £259.61538 \text{ \&c.}$$

$$= £259 \text{ } 12 \text{ } 3\frac{1}{2}.7 + \text{Ans.}$$

$$[2] \quad \frac{rtt - rt + 2t}{2rt + 2} \times u = \frac{.06 \times 5 \times 5 - .06 \times 5 + 2 \times 5}{2 \times .06 \times 5 + 2} \times 80 =$$

$$\frac{1.5 - .3 + 10}{.6 + 2} \times 80 = \frac{11.2}{2.6} \times 80 = \frac{896}{2.6} = £344.61538 \text{ \&c.}$$

$$= £344 \text{ } 12 \text{ } 3\frac{1}{2}.7 + \text{Ans.}$$

$$[3] \quad \frac{rtt - rt + 2t}{2rt + 2} \times u = \frac{.04 \times 7 \times 7 - .04 \times 7 + 2 \times 7}{2 \times .04 \times 7 + 4} \times 40 =$$

$$\frac{1.96 - .28 + 14}{.56 + 2} \times 40 = \frac{15.68}{2.56} \times 40 = \frac{627.2}{2.56} = £245. \text{ Ans.}$$

$$[4] \quad \frac{rit - rt + 2t}{2rt + 2} \times u = \frac{.045 \times 5 \times 5 - .045 \times 5 + 2 \times 5}{2 \times .045 \times 5 + 2} \times 30 =$$

$$\frac{1.125 - .225 + 10}{.45 + 2} \times 30 = \frac{10.9}{2.45} \times 30 = \frac{327}{2.45} = £133.469387 \text{ &c.}$$

$$= £133 \ 9 \ 4\frac{1}{2}.6 + \text{ Ans.}$$

$$[5] \quad \frac{rit - rt + 2t}{2rt + 2} \times u = \frac{.025 \times 12 \times 12 - .025 \times 12 + 2 \times 12}{2 \times .025 \times 12 + 2} \times 25 =$$

$$= \frac{3.6 - .3 + 24}{.6 + 2} \times 25 = \frac{27.3}{2.6} \times 25 = \frac{682.5}{2.6} = £262.5 = £262 \ 10s. \text{ Ans.}$$

$$[6] \quad \frac{rit - rt + 2t}{2rt + 2} \times u = \frac{.0125 \times 24 \times 24 - .0125 \times 24 + 2 \times 24}{2 \times .0125 \times 24 + 2} \times 12.5 =$$

$$\frac{7.2 - .3 + 48}{.6 + 2} \times 12.5 = \frac{54.9}{2.6} \times 12.5 = \frac{686.25}{2.6} =$$

$$£263.9423 \text{ &c.} = £263 \ 18 \ 10 + \text{ Ans.}$$

## Case 2.

$$[1] \quad \frac{rt + 1}{rit - rt + 2t} \times 2p = \frac{.05 \times 6 + 1}{.05 \times 6 \times 6 - .05 \times 6 + 2 \times 6} \times 2 \times$$

$$\frac{675^*}{2.6} = \frac{.3 + 1}{1.8 - .3 + 12} \times \frac{1350}{2.6} = \frac{1.3}{13.5} \times \frac{1350}{2.6} = \frac{1550}{13.5 \times 2} = \frac{675}{13.5}$$

$$= £50. \text{ Ans.}$$

$$[2] \quad \frac{rt + 1}{rit - rt + 2t} \times 2p = \frac{.06 \times 5 + 1}{.06 \times 5 \times 5 - .06 \times 5 + 2 \times 5} \times 2 \times$$

$$\frac{896^*}{2.6} = \frac{.3 + 1}{1.5 - .3 + 10} \times \frac{1792}{2.6} = \frac{1.3}{11.2} \times \frac{1792}{2.6} = \frac{1792}{11.2 \times 2} = \frac{896}{11.2}$$

$$= £80. \text{ Ans.}$$

\* The values of  $p$  are taken from Case 1.

$$[3] \quad \frac{rt+1}{rtt-rt+2t} \times 2p = \frac{.04 \times 7 + 1}{.04 \times 7 \times 7 - .04 \times 7 + 2 \times 7} \times 2 \times$$

$$627.2^* \quad .28 + 1 \quad 1254.4 \quad 1.28 \quad 1254.4 \quad 1254.4$$

$$= \frac{2.56}{1.96 - .28 + 14} \times \frac{1254.4}{2.56} = \frac{1.28}{15.68} \times \frac{1254.4}{2.56} = \frac{1254.4}{15.68 \times 2}$$

$$= \frac{1254.4}{31.36} = £40. \text{ Ans.}$$

$$[4] \quad \frac{rt+1}{rtt-rt+2t} \times 2p = \frac{.045 \times 5 + 1}{.045 \times 5 \times 5 - .045 \times 5 + 2 \times 5} \times 2 \times$$

$$327^* \quad .225 + 1 \quad 654 \quad 1.225 \quad 654 \quad 654$$

$$= \frac{2.45}{1.125 - .225 + 10} \times \frac{654}{2.45} = \frac{1.225}{10.9} \times \frac{654}{2.45} = \frac{654}{10.9 \times 2}$$

$$= \frac{654}{21.8} = £30. \text{ Ans.}$$

$$[5] \quad \frac{rt+1}{rtt-rt+2t} \times 2p = \frac{.025 \times 12 + 1}{.025 \times 12 \times 12 - .025 \times 12 + 2 \times 12} \times$$

$$2 \times 262.5^* \quad .3 + 1 \quad 1.3 \quad 13 \times 525 \quad 525$$

$$= \frac{3.6 - .3 + 24}{27.3} \times \frac{525}{27.3} = \frac{13 \times 525}{27.3} = \frac{525}{21}$$

$$= 25; \text{ and } 25 \times 2 = £50. \text{ Ans.}$$

$$[6] \quad \frac{rt+1}{rtt-rt+2t} \times 2p = \frac{.0125 \times 24 + 1}{.0125 \times 24 \times 24 - .0125 \times 24 + 2 \times 24} \times$$

$$2 \times \frac{686.25}{2.6} = \frac{.3 + 1}{7.2 - .3 + 48} \times \frac{1372.5}{2.6} = \frac{1.3}{54.9} \times \frac{1372.5}{54.9 \times 2}$$

$$= \frac{1372.5}{109.8} = 12.5; \text{ and } 12.5 \times 4 = £50. \text{ Ans.}$$

## Case 3.

$$\begin{aligned}
 [1] \quad & \frac{2ut-2f}{2ft-utt+ut} = \frac{2 \times 50 \times 6 - 2 \times \frac{675}{1.3}}{2 \times \frac{675}{1.3} \times 6 - 50 \times 6 \times 6 + 50 \times 6} \\
 & \frac{600 - \frac{675}{1.3}}{\frac{4050}{1.3} - 1800 + 300} = \frac{\frac{780 - 675}{1.3}}{\frac{4050}{1.3} - 1500} = \frac{\frac{105}{1.3}}{\frac{4050 - 1950}{1.3}} = \frac{\frac{105}{1.3}}{\frac{2100}{1.3}} = \frac{105}{2100} \\
 & \div \frac{105}{1.3} = \frac{1.3}{2100} \times \frac{105}{2100} = .05, \text{ or } 5 \text{ per cent. Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [2] \quad & \frac{2ut-2f}{2ft-utt+ut} = \frac{2 \times 80 \times 5 - 2 \times \frac{896}{1.3}}{2 \times \frac{896}{1.3} \times 5 - 80 \times 5 \times 5 + 80 \times 5} \\
 & \frac{800 - \frac{896}{1.3}}{\frac{4480}{1.3} - 2000 + 400} = \frac{\frac{144}{1.3}}{\frac{4480}{1.3} - 1600} = \frac{\frac{144}{1.3}}{\frac{2400}{1.3}} = \frac{144}{2400} \div \frac{1.3}{1.3} \\
 & \frac{144}{1.3} \times \frac{1.3}{2400} = \frac{144}{2400} = .06, \text{ or } 6 \text{ per cent. Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [3] \quad & \frac{2ut-2f}{2ft-utt+ut} = \frac{2 \times 40 \times 7 - 2 \times 245}{2 \times 245 \times 7 - 40 \times 7 \times 7 + 40 \times 7} \\
 & \frac{560 - 490}{3430 - 1960 + 280} = \frac{70}{1750} = .04, \text{ or } 4 \text{ per cent. Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [4] \quad & \frac{2ut-2f}{2ft-utt+ut} = \frac{2 \times 30 \times 5 - 2 \times \frac{327}{2.45}}{2 \times \frac{327}{2.45} \times 5 - 30 \times 5 \times 5 + 30 \times 5} \\
 & \frac{300 - \frac{654}{2.45}}{\frac{3270}{2.45} - 750 + 150} = \frac{\frac{81}{2.45}}{\frac{3270}{2.45} - 600} = \frac{\frac{81}{2.45}}{\frac{1800}{2.45}} = \frac{81}{1800} \div \frac{2.45}{2.45} \\
 & \frac{81}{2.45} \times \frac{2.45}{1800} = \frac{81}{1800} = .045, \text{ or } 4\frac{1}{2} \text{ per cent. Ans.}
 \end{aligned}$$

\* The values of  $p$  are taken from Case 1.

$$[5] \quad \frac{2ut - 2p}{2pt - utt + ut} = \frac{2 \times 25 \times 12 - 2 \times 262.5}{2 \times 262.5 \times 12 - 25 \times 12 \times 12 + 25 \times 12} = \frac{600 - 525}{75} = \frac{6300 - 3600 + 300}{3000} = .025, \text{ or } 2\frac{1}{2}\%; \text{ and } 2\frac{1}{2}\% \times 2 = 5 \text{ per cent. Ans.}$$

$$[6] \quad \frac{2ut - 2p}{2pt - utt + ut} = \frac{2 \times 12.5 \times 24 - 2 \times 686\frac{2}{3}}{2 \times 686\frac{2}{3} \times 24 - 12.5 \times 24 \times 24 + 12.5 \times 24} = \frac{600 - 686\frac{2}{3}}{93\frac{7}{3}} = \frac{16470}{7500} - \frac{7200 + 300}{93.75} = \frac{16470}{7500} - \frac{6900}{93.75} = \frac{7500}{13} = 13$$

$$\div \frac{1.3}{1.3} = \frac{93.75}{1.3} \times \frac{1.3}{7500} = \frac{93.75}{7500} = .0125 \text{ or } 1\frac{1}{4}\%; \text{ and } 1\frac{1}{4}\% \times 4 = 5 \text{ per cent. Ans.}$$

Case 4.

$$[1] \quad \text{First, } \frac{2}{r} - \frac{2p}{u} - 1 = \frac{2}{.05} - \frac{2 \times 675}{2.6 \times 50} - 1 = 40 - \frac{1350}{130} - 1 = 39 - \frac{135}{13} = \frac{372}{13} = x. \text{ Secondly,}$$

$$\sqrt{\frac{2p}{ru} + \frac{xx}{4} - \frac{x}{2}} = \sqrt{\frac{2 \times 675}{2.6 \times .05 \times 50} + \frac{372 \times 372}{13 \times 13 \times 4} - \frac{372}{13 \times 2}}$$

$$= \sqrt{\frac{1350}{6.5} + \frac{138384}{676} - \frac{372}{26}} = \sqrt{\frac{13500}{65} + \frac{138384}{676} - \frac{372}{26}}$$

$$= \sqrt{\frac{2700}{13} + \frac{138384}{676} - \frac{372}{26}} = \sqrt{\frac{140400}{676} + \frac{138384}{676} - \frac{372}{26}}$$

$$= \sqrt{\frac{278784}{676} - \frac{372}{26}} = \frac{528}{26} - \frac{372}{26} = \frac{156}{26} = 6 \text{ years. Ans.}$$

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$$[2] \quad \text{First, } \frac{2}{r} - \frac{2h}{u} - 1 = \frac{2}{.06} - \frac{2 \times 896}{2.6 \times 80} - 1 = 33\frac{1}{3}$$

$$- \frac{112}{13} - 1 = 32\frac{1}{3} - \frac{112}{13} = \frac{97}{3} - \frac{112}{13} = \frac{925}{39} = x.$$

$$\text{Secondly, } \sqrt{\frac{2h}{ru}} + \frac{xx}{4} - \frac{x}{2} = \sqrt{\frac{2 \times 896}{2.6 \times .06 \times 80}} + \frac{925 \times 925}{39 \times 39 \times 4}$$

$$- \frac{925}{39 \times 2} = \sqrt{\frac{11200}{78} + \frac{855625}{6084}} - \frac{925}{78} = \sqrt{\frac{1729225}{6084}}$$

$$\frac{925}{78} = \frac{1315}{78} - \frac{925}{78} = \frac{390}{78} = 5 \text{ years. Ans.}$$

$$[3] \quad \text{First, } \frac{2}{r} - \frac{2h}{u} - 1 = \frac{2}{.04} - \frac{2 \times 245}{40} - 1 =$$

$$50 - \frac{49}{4} - 1 = 49 - \frac{49}{4} = \frac{147}{4} = x. \quad \text{Secondly,}$$

$$\sqrt{\frac{2h}{ru}} + \frac{xx}{4} - \frac{x}{2} = \sqrt{\frac{2 \times 245}{.04 \times 40}} + \frac{147 \times 147}{4 \times 4 \times 4} - \frac{147}{4 \times 2}$$

$$\sqrt{\frac{4900}{16} + \frac{21609}{64}} - \frac{147}{8} = \sqrt{\frac{41209}{64}} - \frac{147}{8} = \frac{203}{8}$$

$$\frac{147}{8} = \frac{56}{8} = 7 \text{ years. Ans.}$$

[4] First,  $\frac{2}{r} - \frac{2h}{u} - 1 = \frac{2}{.045} - \frac{2 \times 327}{2.45 \times 30} - 1$

$$= 44\frac{4}{9} - \frac{436}{49} - 1 = 43\frac{4}{9} - \frac{436}{49} = \frac{391}{9} - \frac{436}{49} =$$

$$\frac{15235}{441} = x. \text{ Secondly, } \sqrt{\frac{2h}{ru}} + \frac{xx}{4} - \frac{x}{2} =$$

$$\sqrt{\frac{2 \times 327}{2.45 \times .045 \times 30}} + \frac{15235 \times 15235}{441 \times 441 \times 4} - \frac{15235}{441 \times 2} =$$

$$\sqrt{\frac{87200}{441}} + \frac{232105225}{777924} - \frac{15235}{882} = \sqrt{\frac{385926025}{777924}}$$

$$\frac{15235}{882} = \frac{19645}{882} - \frac{15235}{882} = \frac{4410}{882} = 5 \text{ years. Ans.}$$

[5] First,  $\frac{2}{r} - \frac{2h}{u} - 1 = \frac{2}{.025} - \frac{2 \times 262.5}{25} - 1 =$

$$80 - 21 - 1 = 58 = x. \text{ Secondly, } \sqrt{\frac{2h}{ru}} + \frac{xx}{4} - \frac{x}{2} =$$

$$\sqrt{\frac{2 \times 262.5}{.025 \times 25}} + \frac{58 \times 58}{4} - \frac{58}{2} = \sqrt{840 + 841} - 29 = \sqrt{1681}$$

$$- 29 = 41 - 29 = 12 \text{ payments} = 6 \text{ years. Ans.}$$

$$\begin{aligned}
 [6] \quad \text{First, } & \frac{2}{r} - \frac{2p}{u} - 1 = \frac{2}{.0125} - \frac{2 \times 686.25}{2.6 \times 12.5} - 1 \\
 & = 160 - \frac{549}{13} - 1 = 159 - \frac{549}{13} = \frac{1518}{13} = x. \\
 \text{Secondly, } & \left| \frac{2p}{\sqrt{ru}} + \frac{xx}{4} - \frac{x}{2} \right| = \left| \frac{2 \times 686.25}{\sqrt{2.6 \times .0125 \times 12.5}} + \frac{1518 \times 1518}{13 \times 13 \times 4} \right. \\
 & \left. - \frac{1518}{13 \times 2} \right| = \left| \frac{43920}{13} + \frac{2304324}{676} - \frac{1518}{26} \right| = \left| \frac{4588164}{676} \right| \\
 & \frac{1518}{26} = \frac{2142}{26} - \frac{1518}{26} = \frac{624}{26} = 24 \text{ payments} = 6 \text{ years.} \\
 & \text{Ans.}
 \end{aligned}$$

## ANNUITIES, LEASES, &c. TAKEN IN REVERSION.

### Case 1.

$$\begin{aligned}
 [1] \quad \text{First, } & \frac{rtt - rt + 2t}{2rt + 2} \times u = \frac{.04 \times 3 \times 3 - .04 \times 3 + 2 \times 3}{2 \times .04 \times 3 + 2} \\
 \times 30 & = \frac{.36 - .12 + 6}{.24 + 2} \times 30 = \frac{6.24}{2.24} = \frac{587}{7} = p. \\
 \text{Secondly, } & \frac{a}{tr + 1} = \frac{585}{7 \times (2 \times .04 + 1)} = \frac{1025}{21} = 77.38095 \&c. \\
 & = \text{£ } 77 \text{ } 7 \text{ } 7.4 \&c. \text{ Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [2] \quad \text{First, } & \frac{rtt - rt + 2t}{2rt + 2} \times u = \frac{.05 \times 7 \times 7 - .05 \times 7 + 2 \times 7}{2 \times .05 \times 7 + 2} \\
 \times 17 & = \frac{2.45 - .35 + 14}{.7 + 2} \times 17 = \frac{16.1}{2.7} \times 17 = \frac{273.7}{2.7} = p. \\
 \text{Secondly, } & \frac{a}{tr + 1} = \frac{273.7}{2.7 \times (4 \times .05 + 1)} = \frac{273.7}{3.24} = 84.4753 \&c. \\
 & = \text{£ } 84 \text{ } 9 \text{ } 6 + \text{ Ans.}
 \end{aligned}$$



$$[3] \quad \text{First, } \frac{rtt - rt + 2t}{2rt + 2} \times u = \frac{.04 \times 8 \times 8 - .04 \times 8 + 2 \times 8}{2 \times .04 \times 8 + 2}$$

$$\times 20 = \frac{2.56 - .32 + 16}{.64 + 2} \times 20 = \frac{18.24}{2.64} \times 20 = \frac{1520}{11} = p.$$

$$\text{Secondly, } \frac{a}{tr + 1} = \frac{1520}{11 \times (5 \times .04 + 1)} = \frac{1520}{13.2} =$$

$$115.151515, \&c. = £ 115 \ 3 \ 0\frac{1}{2} \ .5 \ \&c. \ \text{Ans.}$$

$$[4] \quad \text{First, } \frac{rtt - rt + 2t}{2rt + 2} \times u = \frac{.1 \times 12 \times 12 - .1 \times 12 + 2 \times 12}{2 \times .1 \times 12 + 2}$$

$$\times 35 = \frac{14.4 - 1.2 + 24}{2.4 + 2} \times 35 = \frac{37.2}{4.4} \times 35 = \frac{3255}{11} = p.$$

$$\text{Secondly, } \frac{a}{tr + 1} = \frac{3255}{11 \times (5 \times .1 + 1)} = \frac{3255}{16.5} = \frac{2170}{11} =$$

$$197.272727 \ \&c. = £ 197 \ 5 \ 5\frac{1}{4} \ .792 \ \&c. \ \text{Ans.}$$

Case 2.

$$[1] \quad \text{First, } ptr + p = \frac{1625^*}{21} \times 2 \times .04 + \frac{1625}{21} = \frac{130}{21} +$$

$$\frac{1625}{21} = \frac{1755}{21} = \frac{585}{7} = a. \quad \text{Secondly, } \frac{rt + 1}{rtt - rt + 2t} \times 2p$$

$$= \frac{.04 \times 3 + 1}{.04 \times 3 \times 3 - .04 \times 3 + 2 \times 3} \times 2 \times \frac{585}{7} = \frac{.12 + 1}{.36 - .12 + 6}$$

$$\times \frac{1170}{7} = \frac{1.12 \times 1170}{6.24 \times 7} = \frac{1310.4}{43.68} = £ 30. \ \text{Ans.}$$

\* The values of  $p$  are taken from Case 1.

$$[2] \quad \text{First, } p_{tr} + p = \frac{273.7}{3.24} \times 4 \times .05 + \frac{273.7}{3.24} =$$

$$\frac{54.74}{3.24} + \frac{273.7}{3.24} = \frac{328.44}{3.24} = \frac{2737}{27} = a. \quad \text{Secondly,}$$

$$\frac{rt + 1}{rtt - rt + 2t} \times 2p = \frac{.05 \times 7 + 1}{.05 \times 7 \times 7 - .05 \times 7 + 2 \times 7} \times 2 \times \frac{2737}{27}$$

$$= \frac{.35 + 1}{2.45 - .35 + 14} \times \frac{5474}{27} = \frac{1.35}{16.1} \times \frac{5474}{27} = \frac{7389.9}{434.7} =$$

£ 17. Ans.

$$[3] \quad \text{First, } p_{tr} + p = \frac{1520}{13.2} \times 5 \times .04 + \frac{1520}{13.2} = \frac{304}{13.2}$$

$$+ \frac{1520}{13.2} = \frac{1824}{13.2} = \frac{1520}{11} = a. \quad \text{Secondly, } \frac{rt + 1}{rtt - rt + 2t}$$

$$\times 2p = \frac{.04 \times 8 + 1}{.04 \times 8 \times 8 - .04 \times 8 + 2 \times 8} \times 2 \times \frac{1520}{11} =$$

$$\frac{.32 + 1}{2.56 - .32 + 16} \times \frac{3040}{11} = \frac{1.32}{18.24} \times \frac{3040}{11} = \frac{4012.8}{200.64} = £ 20. \quad \text{Ans.}$$

$$[4] \quad \text{First, } p_{tr} + p = \frac{2170}{11} \times .1 \times 5 + \frac{2170}{11} = \frac{1085}{11}$$

$$+ \frac{2170}{11} = \frac{3255}{11} = a. \quad \text{Secondly, } \frac{rt + 1}{rtt - rt + 2t} \times 2p =$$

$$\frac{.1 \times 12 + 1}{.1 \times 12 \times 12 - .1 \times 12 + 2 \times 12} \times 2 \times \frac{3255}{11} = \frac{1.2 + 1}{14.4 - 1.2 + 24}$$

$$\times \frac{6510}{11} = \frac{2.2}{37.2} \times \frac{6510}{11} = \frac{14322}{409.2} = £ 35. \quad \text{Ans.}$$

## SIMPLE INTEREST FOR DAYS.

235

## SIMPLE INTEREST FOR DAYS.

[1] From the table,  
 .00010958904  
 120 -

.01315068480  
 126

7890410880  
 15780821760

1.65698628480  
 20

13.13972569600  
 12

1.676708352  
 4

2.706833408

Ans. £ 1 13 1 $\frac{1}{2}$  +

[2] From the table,  
 .00016438356  
 126

98630136  
 197260272

.02071232856  
 145

10356164280  
 8284931424  
 2071232856

3.00328764120  
 20

0.06575282400  
 12

0.78903388800  
 4

3.15613555200

Ans. £ 3 0 0 $\frac{3}{4}$  +

[3]	From the table,	.0001369863
June 30		100
July 31		
Aug. 31		.0136986300
Sept. 30		281
Oct. 31		
Nov. 30		1369863
Dec. 31		10958904
Jan. 31		2739726
Feb. 28		
March 8		3.84931503
		20
		281

16.98630060  
 12

11.8356072  
 4

3.3424288

Ans. £ 3 16 11 $\frac{1}{2}$  +

[4]

From the table, .00016438356

200

Aug. 18

Sept. 30

Oct. 31

Nov. 30

Dec. 19

128

.03287671200

128

263013696

394520544

4.208219136

20

4.164382720

12

1.97259264

4

Ans. £ 4 4 1 $\frac{3}{4}$  +

3.89037056

[5]

From the table,

.0001369863

10

.0013698630

25

6849315

2739726

.034246575

20

.684931500

12

8.2191780

Ans. 8d. +

[6]

From the table,

.00010958904

40

.00438356160

40

.17534246400

20

3.50684928000

12

6.08219136

Ans. 3s. 6d. +

## REBATE OR DISCOUNT.

Case 1.

$$\begin{array}{r}
 12 \mid 2 \\
 20 \mid 11.16666 \\
 s \quad 795.55833 \text{ \&c.} \quad 795.55833 \text{ \&c.} \\
 [1] \quad \frac{\quad}{tr+1} = \frac{\quad}{\frac{1}{2} \times .06 + 1} = \frac{\quad}{1.055} = \\
 754.0837 \text{ \&c.} = £ 754 \ 1 \ 8 + \text{ Ans.}
 \end{array}$$

NOTE. Perhaps by vulgar fractions is the most preferable method: thus,

$$[2] \quad \begin{array}{ccccccc} m. & m. & £. & 5 \times 19 & 95 & £. & £. \\ 12 : 19 :: 5 : \frac{\quad}{12} = \frac{95}{12}; \text{ and } 100 \frac{95}{12} : 100 \end{array}$$

$$\begin{array}{ccccccc} £. & 323 \times 100 \times \frac{6}{12} & £. & 38760 \\ :: 161 \frac{1}{2} : \frac{\quad}{2 \times 1 \times 1295} = \frac{\quad}{259} = £ 149 \ 13 \ 1 + \text{ Ans.} \end{array}$$

[3] From July 24th to Dec. 25th inclusive are 155 days :

$$\begin{array}{ccccccc} D. & D. & £. & 6 \times 155 & 186 & £. & £. \\ \text{therefore } 365 : 155 :: 6 : \frac{\quad}{365} = \frac{186}{73}; \text{ and } 100 \frac{186}{73} : \end{array}$$

$$\begin{array}{ccccccc} £. & £. & 1000 \times 100 \times 73 & 7300000 \\ 100 :: 1000 : \frac{\quad}{1 \times 1 \times 7486} = \frac{\quad}{7486} = £ 975 \ 3 \ 0 \frac{1}{2} + \text{ Ans.} \end{array}$$

Case 2.

[1]

£.	s.	d.
754	1	8
		6
<hr/>		
4524	10	0
		11
<hr/>		
12) 49769	10	0
<hr/>		
41,47	9	2
		20
<hr/>		
9,49		
		12
<hr/>		
5,99		
		4
<hr/>		
3,60		

£.	s.	d.
754	1	8
41	9	5½
<hr/>		
6795	11	1½ + Ans.

Or thus; taking  $\bar{p}$  from Case 1.

$$[2] \quad \bar{p}tr + \bar{p} = \frac{38760 \times 19}{259 \times 12} \times .05 + \frac{38760}{259} = \frac{3068.5}{259} +$$

$$\frac{38760}{259} = \frac{41828.5}{259} = 161.5 = £ 161 \text{ } 10s. \text{ Ans.}$$

[3] The time in this question is 155 days; therefore,

$$t = \frac{155}{365} = \frac{31}{73}; \text{ and } \bar{p}tr + \bar{p} = \frac{7300000 \times 31}{7486 \times 73} \times .06 + \frac{7300000}{7486}$$

$$= \frac{186000}{7486} + \frac{7300000}{7486} = \frac{7486000}{7486} = £ 1000. \text{ Ans.}$$

## Case 3.

Taking  $s$ ,  $r$ , &c. from the other Cases.

$$[1] \quad \frac{s-r}{rp} = \frac{795.5583 \text{ \&c.} - 754.0837 \text{ \&c.}}{.06 \times 754.0837 \text{ \&c.}} = \frac{41.4746 \text{ \&c.}}{45.245022 \text{ \&c.}}$$

$$= \frac{11}{12} \text{ nearly} = 11 \text{ months. Ans.}$$

NOTE. When there are decimal remainders in  $s$ ,  $r$ , &c. the exact answer will not be obtained.

$$[2] \quad \frac{s-r}{rp} = \left(161\frac{1}{2} - \frac{38760}{259}\right) \div \left(.05 \times \frac{38760}{259}\right) =$$

$$\left(\frac{323}{2} - \frac{38760}{259}\right) \div \frac{1938}{259} = \left(\frac{83657 - 77520}{518}\right) \div \frac{1938}{259} = \frac{6137}{518}$$

$$\times \frac{259}{1938} = \frac{6137}{3876} = \frac{19}{12} = 19 \text{ mo. Ans.}$$

$$[3] \quad \frac{s-r}{rp} = \left(1000 - \frac{7300000}{7486}\right) \div \left(.06 \times \frac{7300000}{7486}\right) =$$

$$\frac{7486000 - 730000}{7486} \div \frac{438000}{7486} = \frac{186000}{7486} \times \frac{7486}{438000} = \frac{186}{438}$$

$$\frac{81}{73} = \frac{155}{365} = 155 \text{ days. Ans.}$$

## Case 4.

NOTE.  $s$ ,  $r$ , &c. are taken from the other Cases.

$$[1] \quad \frac{s-r}{rp} = \frac{795.5583 \text{ \&c.} - 754.0837 \text{ \&c.}}{\frac{11}{12} \times 754.0837 \text{ \&c.}} =$$

$$\frac{41.4746 \text{ \&c.}}{691.2434 \text{ \&c.}} = .06 \text{ Ans.}$$

$$[2] \quad \frac{s - p}{tr} = \left(161\frac{1}{2} - \frac{38760}{259}\right) \div \left(\frac{19}{12} \times \frac{3230}{259}\right) =$$

$$\frac{6137}{518} \div \frac{19 \times 3230}{259} = \frac{6137}{518} \times \frac{259^1}{61370} = \frac{6137}{122740} = .05 \text{ Ans.}$$

$$[3] \quad \frac{s - p}{tr} = \left(1000 - \frac{7300000}{7486}\right) \div \left(\frac{31}{73} \times \frac{100000}{7486}\right) =$$

$$\frac{186000}{7486} \div \frac{3100000}{7486} = \frac{186000}{7486} \times \frac{7486^1}{3100000} = \frac{186}{3100} = .06 \text{ Ans.}$$

## EQUATION OF PAYMENTS. THE TRUE WAY.

$$[1] \quad \text{First, } \frac{s}{tr+1} = 100 \div \left(\frac{1}{12} \times .06 + 1\right) = 100 \div$$

$$1.01 = \frac{100}{1.01} = \frac{10000}{101} \quad \text{Secondly, } \frac{s}{tr+1} = 100 \div$$

$$\left(\frac{1}{12} \times .06 + 1\right) = 100 \div 1.02 = \frac{100}{1.02} = \frac{10000}{102}$$

$$\frac{5000}{51} \quad \text{Thirdly, } \frac{10000}{101} + \frac{5000}{51} = \frac{1015000}{5151} = p.$$

$$\text{Fourthly, } \frac{s - p}{tr} = 200 - \frac{1015000}{5151} = \frac{15200}{5151} = d. \quad \text{Fifthly,}$$

$$\frac{d}{pr} = \frac{15200}{5151} \div \left(.06 \times \frac{1015000}{5151}\right) = \frac{15200}{5151} \div \frac{60900}{5151} = \frac{152,00}{5151} \times$$

$$\frac{5151^1}{609,00} = \frac{152}{609} \text{ year} = \frac{152 \times 12}{609} \text{ mo.} = \frac{608}{203} \text{ mo.} = 3 \text{ months nearly. Ans.}$$



$$[2] \text{ First, } \frac{s}{tr+1} = 50 \div (\frac{2}{12} \times .05 + 1) = 50 \div (\frac{1}{6} + 1) =$$

$$50 \div \frac{12.1}{12} = \frac{50}{1} \times \frac{12}{12.1} = \frac{600}{12.1} = \frac{6000}{121}. \text{ Secondly, } \frac{s}{tr+1}$$

$$= 100 \div (\frac{5}{12} \times .05 + 1) = 100 \div (\frac{25}{24} + 1) = 100 \div \frac{12.25}{12} =$$

$$100 \times \frac{12}{12.25} = \frac{120000}{1225} = \frac{4800}{49}. \text{ Thirdly, } \frac{s}{tr+1} = 150 \div$$

$$(\frac{3}{12} \times .05 + 1) = 150 \div (\frac{4}{12} + 1) = 150 \div \frac{12.4}{12} = \frac{150}{1} \times \frac{120}{124}$$

$$= \frac{4500}{31}. \text{ Fourthly, } \frac{6000}{121} + \frac{4800}{49} + \frac{4500}{31} = \frac{53799300}{183799} = f.$$

$$\text{Fifthly, } s - f = 300 - \frac{53799300}{183799} = \frac{1340400}{183799} = d.$$

$$\text{Sixthly, } \frac{d}{fr} = \frac{1340400}{183799} \div (.05 \times \frac{53799300}{183799}) = \frac{1340400}{183799} \div$$

$$\frac{2689965}{183799} = \frac{1340400}{183799} \times \frac{183799}{2689965} = \frac{1340400}{2689965} \text{ year} =$$

$$\frac{1340400 \times 12}{2689965} \text{ mo.} = 5.9796 \text{ mo.} \text{ Ans.}$$

[3] First, Since the first payment is at the present time :

$$\text{will} = 0; \text{ and } \frac{s}{tr+1} = \frac{200}{0 \times .04 + 1} = \frac{200}{0+1} = \frac{200}{1} = 200. \text{ Second-}$$

$$\text{ly, } \frac{s}{tr+1} = 400 \div \left( \frac{1}{12} \times .04 + 1 \right) = 400 \div \left( \frac{1}{12} + 1 \right) = 400$$

$$\div \frac{12.2}{12} = 400 \times \frac{12}{12.2} = \frac{4800}{12.2} = \frac{48000}{122} = \frac{24000}{61}. \text{ Thirdly,}$$

$$\frac{s}{tr+1} = 400 \div \left( \frac{10}{12} \times .04 + 1 \right) = 400 \div \left( \frac{1}{3} + 1 \right) = \frac{400}{1}$$

$$\frac{12.4}{12} = \frac{400}{1} \times \frac{12}{12.4} = \frac{4800}{12.4} = \frac{48000}{124} = \frac{12000}{31}. \text{ Fourthly,}$$

$$\frac{200}{1} + \frac{24000}{61} + \frac{12000}{31} = \frac{1854200}{1891} = p. \text{ Fifthly, } s - p = 1000$$

$$\frac{1854200}{1891} = \frac{36800}{1891} = d. \text{ Sixthly, } \frac{d}{pr} = \frac{36800}{1891} \div (.04 \times$$

$$\frac{1854200}{1891}) = \frac{36800}{1891} \div \frac{74168}{1891} = \frac{36800}{1891} \times \frac{1891}{74168} =$$

$$\frac{36800}{74168} \text{ year} = \frac{36800 \times 365}{74168} \text{ day} = 181 + \text{Days. Ans.}$$

[4] First, as in the preceding,  $\frac{s}{tr+1} = 200$ . Secondly,

$$\frac{s}{tr+1} = 500 \div \left(\frac{10}{12} \times .03 + 1\right) = 500 \div \left(\frac{3}{4} + 1\right) =$$

$$500 \div \frac{12.3}{12} = 500 \times \frac{120}{123} = \frac{60000}{123} = \frac{20000}{41}. \text{ Thirdly,}$$

$$\frac{s}{tr+1} = 500 \div \left(\frac{20}{12} \times .03 + 1\right) = 500 \div \left(\frac{5}{3} + 1\right) =$$

$$500 \div \frac{12.6}{12} = 500 \times \frac{12}{12.6} = \frac{500}{1} \times \frac{120}{126} = \frac{60000}{126} =$$

$$\frac{10000}{21}. \text{ Fourthly, } \frac{200}{1} + \frac{20000}{41} + \frac{10000}{21} = \frac{1002200}{861} = p.$$

$$\text{Fifthly, } 1200 - \frac{1002200}{861} = \frac{31000}{861} = d. \text{ Sixthly, } \frac{d}{tr}$$

$$= \frac{31000}{861} \div \left(.03 \times \frac{1002200}{861}\right) = \frac{31000}{861} \div \frac{30066}{861} = \frac{31000}{861}$$

$$\times \frac{861}{30066} = \frac{31000}{30066} \text{ year} = 1 \text{ year } 11 + \text{ days, Ans.}$$

# COMPOUND INTEREST.

## COMPOUND INTEREST.

Case 1.

[1]

$$\begin{array}{r}
 1.05 \\
 1.05 \\
 \hline
 525 \\
 105 \\
 \hline
 1,1025 \\
 1.05 \\
 \hline
 55125 \\
 11025 \\
 \hline
 1.157625 = r^t \\
 450 = p \\
 \hline
 57881250 \\
 4630500 \\
 \hline
 520.931250 = a \\
 20 \\
 \hline
 18.625000 \\
 12 \\
 \hline
 7.500 \\
 4 \\
 \hline
 2.0
 \end{array}$$

Ans. \$ 520 18 7½

[2]

$$\begin{array}{r}
 1.06 \\
 1.06 \\
 \hline
 636 \\
 106 \\
 \hline
 1.1236 \\
 1.1236 \\
 \hline
 67416 \\
 33708 \\
 22472 \\
 123596 \\
 \hline
 1.26247696 = r^t \\
 400 = p \\
 \hline
 504.99078400 = a \\
 20 \\
 \hline
 19.81568000 \\
 12 \\
 \hline
 9.78816 \\
 4 \\
 \hline
 3.15264
 \end{array}$$

Ans. \$ 504 19 9¾ .15264

# COMPOUND INTEREST.

245

[3]

1.05  
1.05

525  
105

1.1025  
1.05

55125  
11025

1.157625  
1.157625

5788125  
2315250

6945750

8103375

5788125

12733875

1.340095640625  
480

107207651250000  
5360382562500

643.2459075  
20

4.9181500  
12

11.0178

Ans. £ 643 4 11.0178

[4]

1.0425  
1.0425

52125  
20850  
41700

10425

1.08680625  
1.08680625

543403125

217361250

652083750

869445000

652083750

869445000

108680625

1.1811478250390625

500

590.57391251953125

20

11.478250390625

12

5.7390046875

4

2.95601875

Ans. £ 590 11 5½ .95601875

## Case 2.

NOTE.  $r^t$  and  $a$  are taken from Case 1, where the method for finding  $r^t$  is shewn.

$$r^t = 1.157625)520.931250(450 = p. \quad \text{Ans.} \quad \pounds$$


---


$$4630500$$


---


$$5788125$$


---


$$5788125$$


---


$$0$$

$$r^t = 1.26247696)504.99078400(400 = p. \quad \text{Ans.} \quad \pounds$$


---


$$504990784$$


---


$$00$$

$$r^t = 1.340095640625)643.245907500000(480 = p. \quad \text{Ans.} \quad \pounds$$


---


$$5360382562500$$


---


$$10720765125000$$


---


$$10720765125000$$


---


$$0$$

$$r^t = 1.1811478250390625)590.5739125195312500(500 = p. \quad \text{Ans.} \quad \pounds$$


---


$$59057391251953125$$


---


$$00$$

Case 3.

NOTE.  $a$ ,  $n$ , &c. are taken from Case 1.

[1]			
	1.05	1.05	1.05
450)520.931250(1.157625(1.1025(1.05(1			
450	105	105	105
<hr/>	<hr/>	<hr/>	
709	107	525	
450	105	525	
<hr/>	<hr/>		
2593	262		
2250	210		
<hr/>	<hr/>		
3431	525		
3150	525		
<hr/>			
2812			
2700			
<hr/>			
1125			
900			
<hr/>			
2250			
2250			

Here there were *three* divisions by 1.05 ; therefore  $t = 3$  years. Ans.

[2]			
4,00)5,04.990784			
	1.06	1.06	1.06
1.06)1.26247696(1.191016(1.1236(1.06(1.			
106	106	106	106
<hr/>	<hr/>	<hr/>	
202	131	636	
106	106	636	
<hr/>	<hr/>		
964	250		
954	212		
<hr/>	<hr/>		
107	381		
106	318		
<hr/>	<hr/>		
169	636		
106	636		
<hr/>			
636			

Here there were *four* divisions by 106 ; therefore  $t = 4$  yrs. Ans.

48,0)64,3.2459075000

[3]

6 ) 8.04057384375

$1.05$	$1.05$	$1.05$	$1.05$	$1.05$	$1.05$
1.348095640625	1.2762815625	1.21550625	1.157625	1.1025	1.05
105	105	105	105	105	105
290	226	165	107	525	
210	210	105	105	525	
800	162	605	262		
735	105	525	210		
659	578	800	525		
630	525	735	525		
295	531	656			
210	525	630			
856	656	262			
840	630	210			
164	262	525			
105	210	525			
590	525				
525	525				
656					
630					
262					
210					
525					
525					

Here there were six divisions by 1.05;  
therefore  $t = 6$  years. Ans.



[4]

5,00)	5,90.57391251953125	1.0425	1.0425	1.0425
1.0425)	1.1811478250390625	(1.132995515625)	1.08680625)	1.0425(1
10425	10425	10425	10425	10425
13864	90495	44306		
10425	83400	41700		
34397	70955	26062		
31275	62550	20850		
31228	84051	52125		
20850	83400	52125		
103782	65156			
93825	62550			
99575	26062			
93825	20850			
57500	52125			
52125	52125			
53753				
52125				
16289				
10425				
58640				
52125				
65156				
62550				
26062				
20850,				
52125				
52125				

Here there were *four* divisions By  
1.0425; therefore  $t = 4$  years. Ans.

## Case 4.

NOTE. In the following examples  $r^t$  is taken from Case 3 : but in working questions of this nature the learner must divide  $a$  the amount, by  $p$  the principal, to obtain  $r^t$ . See the rule.

[1]

$$\begin{array}{r}
 1.157625(1.05 = r = 5 \text{ per cent.} \quad \text{Ans.} \\
 1^3 = 1 \\
 \hline
 1^2 \times 3 = 3) 1 \\
 \hline
 10^3 = 1000 \\
 \hline
 10^3 \times 3 = 300) 1576 \\
 \hline
 105^3 = 1157625
 \end{array}$$


---

[2]

$$\begin{array}{r}
 1.26247696(1.1236(1.06 = r = 6 \text{ per cent.} \quad \text{Ans.} \\
 1 \qquad \qquad \qquad 1 \\
 \hline
 \begin{array}{r|l}
 21 & 26 \\
 1 & 21
 \end{array}
 \qquad
 \begin{array}{r|l}
 206 & 1236 \\
 & 1236
 \end{array} \\
 \hline
 \begin{array}{r|l}
 222 & 524 \\
 2 & 444
 \end{array} \\
 \hline
 \begin{array}{r|l}
 2243 & 8076 \\
 3 & 6729
 \end{array} \\
 \hline
 \begin{array}{r|l}
 22466 & 134796 \\
 & 134796
 \end{array}
 \end{array}$$

[3]  $1.340095640625$  (  $1.157625(1.05 = r = 5 \text{ per cent.}$   
 $1 \quad 1^3 = 1$  Ans.

$$\begin{array}{r|l} 21 & 34 \\ 1 & 21 \end{array} \quad 1^2 \times 3 = 3)1$$


---


$$10^3 = 1000$$

$$\begin{array}{r|l} 225 & 1300 \\ 5 & 1125 \end{array} \quad 10^2 \times 3 = 300)1576$$

$$\begin{array}{r|l} 2307 & 17595 \\ 7 & 16149 \end{array} \quad 1157625$$

$$\begin{array}{r|l} 23146 & 144664 \\ 6 & 138876 \end{array}$$

$$\begin{array}{r|l} 231522 & 578806 \\ 2 & 463044 \end{array}$$

$$\begin{array}{r|l} 2315245 & 11576225 \\ & 11576225 \end{array}$$

[4]  $1.1811478250390625$  )  $1.08680625(1.0425 = r = 4\frac{1}{4}$   
 $1 \quad 1$  per cent. Ans.

$$\begin{array}{r|l} 208 & 1811 \\ 8 & 1664 \end{array} \quad \begin{array}{r|l} 204 & 0868 \\ 4 & 816 \end{array}$$

$$\begin{array}{r|l} 2166 & 14747 \\ 6 & 12996 \end{array} \quad \begin{array}{r|l} 2082 & 5206 \\ 2 & 4164 \end{array}$$

$$\begin{array}{r|l} 21728 & 175182 \\ 8 & 173824 \end{array} \quad \begin{array}{r|l} 20845 & 104225 \\ & 104225 \end{array}$$

$$\begin{array}{r|l} 2173606 & 13585039 \\ 6 & 13041636 \end{array}$$

$$\begin{array}{r|l} 21736122 & 54340306 \\ 2 & 43472244 \end{array}$$

$$\begin{array}{r|l} 217361245 & 1086806225 \\ & 1086806225 \end{array}$$

## ANNUITIES OR PENSIONS IN ARREARS.

Case 1.

$$\begin{aligned}
 [1] \quad & \frac{ur^t - u}{r - 1} = \frac{30 \times 1.05^4 - 30}{1.05 - 1} = \frac{30 \times 1.21550625 - 30}{.05} \\
 & = \frac{36.4651875 - 30}{.05} = \frac{6.4651875}{.05} = 129.30375 = \\
 & \text{£ } 129 \text{ } 6 \text{ } 0\frac{3}{4} \text{ } .6 \text{ Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [2] \quad & \frac{ur^t - u}{r - 1} = \frac{50 \times 1.04^5 - 50}{1.04 - 1} = \frac{50 \times 1.2166529024 - 50}{.04} \\
 & = \frac{60.83264512 - 50}{.04} = \frac{10.83264512}{.04} = 270.816128 = \\
 & \text{£ } 270 \text{ } 16 \text{ } 3\frac{1}{2} \text{ } .48288 \text{ Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [3] \quad & \frac{ur^t - u}{r - 1} = \frac{40 \times 1.06^7 - 40}{1.06 - 1} = \frac{40 \times 1.50363025899136 - 40}{.06} \\
 & = \frac{60.1452103596544 - 40}{.06} = \frac{20.1452103596544}{.06} = \\
 & 335.75350599424 = \text{£ } 335 \text{ } 15 \text{ } 0\frac{3}{4} \text{ } .36 + \text{ Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [4] \quad & \frac{ur^t - u}{r - 1} = \frac{35 \times 1.055^6 - 35}{1.055 - 1} = \frac{35 \times 1.378842806761890625 - 35}{.055} \\
 & = \frac{9.651899647333234375 - 35}{.011} = \frac{2.651899647333234375}{.011} = \\
 & 241.081786121203125 = \text{£ } 241 \text{ } 1 \text{ } 7\frac{1}{2} \text{ } .5 + \text{ Ans.}
 \end{aligned}$$

Case 2.

NOTE.  $a$  and  $r^t$  are taken from Case 1 ; but in original questions the learner must find  $r^t$ , as directed.

$$\begin{aligned}
 [1] \quad & \frac{ra-a}{r^t-1} = \frac{1.05 \times 129.30375 - 129.30375}{1.05^4 - 1} = \\
 & \frac{135.7689375 - 129.30375}{1.21550625 - 1} = \frac{6.4651875}{.21550625} = \text{£ } 30. \text{ Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [2] \quad & \frac{ra-a}{r^t-1} = \frac{1.04 \times 270.816128 - 270.816128}{1.04^5 - 1} = \\
 & \frac{281.64877312 - 270.816128}{1.2166529024 - 1} = \frac{10.83264512}{.2166529024} = \text{£ } 50. \text{ Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [3] \quad & \frac{ra-a}{r^t-1} = \frac{1.06 \times 335.75350599424 - 335.75350599424}{1.06^7 - 1} = \\
 & \frac{355.8987163538944 - 335.75350599424}{1.50363025899136 - 1} = \\
 & \frac{20.1452103596544}{.50363025899136} = \text{£ } 40. \text{ Ans.}
 \end{aligned}$$

$$\begin{aligned}
 [4] \quad & \frac{ra-a}{r^t-1} = \frac{1.055 \times 241.081786121203125 - 241.081786121203125}{1.055^6 - 1} = \\
 & \frac{254.341284357869296875 - 241.081786121203125}{1.378842806761890625 - 1} = \\
 & \frac{13.259498236666171875}{.378842806761890625} = \text{£ } 35. \text{ Ans.}
 \end{aligned}$$

## Case 3.

NOTE.  $a$ , in decimals, is taken from Case 1.

$$[1] \quad \frac{ra+u-a}{u} = \frac{1.05 \times 129.30375 + 30 - 129.30375}{30}$$

$$= \frac{135.7689375 + 30 - 129.30375}{30} = \frac{36.4651875}{30} =$$

1.21550625 =  $rt$ . And

1.05 )	1.21550625	(	$\frac{1.05}{1.05}$	(	$\frac{1.05}{1.05}$	(	$\frac{1.05}{1.05}(1.$
	105		105		105		105
	165		107		525		
	105		105		525		
	605		262				
	525		210				
	800		525				
	735		525				
	656						
	630						
	262						
	210						
	525						
	525						

Here there were *four* divisions by 1.05 ; therefore  $t = 4$  years. Ans.

$$[2] \quad \frac{ra+u-a}{u} = \frac{1.04 \times 270.816128 + 50 - 270.816128}{50}$$

$$= \frac{281.64877312 + 50 - 270.816128}{50} = \frac{60.83264512}{50}$$

1.2166529024 =  $r^t$ . And

1.04)	1.2166529024)	$\frac{1.04}{1.16985856}$	$\frac{1.04}{1.124864}$	$\frac{1.04}{1.0816}$	$\frac{1.04}{1.04}$
104	104	104	104	104	104
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
176	129	848	416		
104	104	832	416		
<hr/>	<hr/>	<hr/>	<hr/>		
726	258	166			
624	208	104			
<hr/>	<hr/>	<hr/>			
1025	505	624			
936	416	624			
<hr/>	<hr/>	<hr/>			
892	898				
832	832				
<hr/>	<hr/>				
609	665				
520	624				
<hr/>	<hr/>				
890	416				
832	416				
<hr/>					
582					
520					
<hr/>					
624					
624					

Here there were *five* divisions by 1.04; therefore  $t = 5$  years. Ans.

$$\begin{aligned} \frac{ra+u-a}{u} &= \frac{1.06 \times 335.75350599424 + 40 - 335.75350599424}{40} \\ &= \frac{355.8987163538944 + 40 - 335.75350599424}{40} = \end{aligned}$$

$$\frac{60.1452103596544}{40} = 1.50363025899136 = r^1 \quad \text{And}$$

[illegible]





## PRESENT WORTH OF ANNUITIES, PENSIONS, &amp;c.

Case 1.

$$\begin{array}{r}
 \text{[1]} \\
 \frac{ur^t - u}{r^t \times (r - 1)} = \frac{20 \times 1.05^6 - 20}{1.05^6 \times (1.05 - 1)} = \frac{20 \times 1.340095640625 - 20}{1.340095640625 \times .05} \\
 = \frac{6.8019128125}{.06700478203125} = 101.51384 \text{ \&c.} = \text{£ } 101 \text{ } 10 \text{ } 3\frac{1}{4} + \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{[2]} \\
 \frac{ur^t - u}{r^t \times (r - 1)} = \frac{30 \times 1.04^5 - 30}{1.04^5 \times (1.04 - 1)} = \frac{30 \times 1.2166529024 - 30}{1.2166529024 \times .04} \\
 = \frac{6.499587072}{.048666116096} = 133.554672 \text{ \&c.} = \text{£ } 133 \text{ } 11 \text{ } 1 + \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{[3]} \\
 \frac{ur^t - u}{r^t \times (r - 1)} = \frac{50 \times 1.03^4 - 50}{1.03^4 \times (1.03 - 1)} = \frac{50 \times 1.12550881 - 50}{1.12550881 \times .03} \\
 = \frac{6.2754405}{.0337652643} = 185.85492 \text{ \&c. and } 50 \times 4 = 185.85492 \text{ \&c.} \\
 = 14.14508 \text{ \&c.} = \text{£ } 14 \text{ } 2 \text{ } 10\frac{1}{2} \text{ Ans.}
 \end{array}$$

$$\begin{array}{r}
 \text{[4]} \\
 \frac{ur^t - u}{r^t \times (r - 1)} = \frac{70 \times 1.0575^4 - 70}{1.0575^4 \times (1.0575 - 1)} = \frac{70 \times 1.2506088687890625 - 70}{1.2506088687890625 \times .0575} \\
 = \frac{17.542620815234375}{.07191000995537109375} \\
 = 243.952418 = \text{£ } 243 \text{ } 19 \text{ } 0\frac{1}{2} \text{ to be paid down.} \\
 \text{£ } 36 \text{ } 0 \text{ } 11\frac{1}{2} \text{ to be discounted.}
 \end{array}$$

Case 2.

NOTE 1.  $p$  and  $r^t$  are taken from Case 1.

NOTE 2. As  $p$  has decimal remainders, the exact answer is not obtained.

$$[1] \quad \frac{prt \times r - 1}{r^t - 1} = \frac{101.51384 \text{ \&c.} \times 1.340095640625 \times .05}{1.340095640625 - 1}$$

$$= \frac{6.8019125 \text{ \&c.}}{.3400956 \text{ \&c.}} = £ 20 \text{ nearly. Ans.}$$

$$[2] \quad \frac{prt \times r - 1}{r^t - 1} = \frac{133.554672 \text{ \&c.} \times 1.2166529024 \times .04}{1.2166529024 - 1}$$

$$= \frac{6.49958716 \text{ \&c.}}{.2166529024} = £ 30 \text{ nearly. Ans.}$$

$$[3] \quad \frac{prt \times r - 1}{r^t - 1} = \frac{185.85492 \text{ \&c.} \times 1.12550881 \times .03}{1.12550881 - 1}$$

$$= \frac{6.2754402 \text{ \&c.}}{.12550881} = £ 50 \text{ nearly. Ans.}$$

$$[4] \quad \frac{prt \times r - 1}{r^t - 1} = \frac{243.952418 \text{ \&c.} \times 1.2506088687890625 \times .0575}{1.2506088687890625 - 1}$$

$$= \frac{17.54261831 \text{ \&c.}}{.2506088687 \text{ \&c.}} = £ 70 \text{ nearly. Ans.}$$

Case 3:

NOTE.  $p$  is taken from Case 1: but as it has decimal remainders,  $r^t$  cannot be obtained exactly.

$$[1] \quad \frac{u}{p + u - pr} = \frac{20}{101.51384 \text{ \&c.} + 20 - 1.05 \times 101.51384 \text{ \&c.}}$$

$$= \frac{20}{14.92431 \text{ \&c.}} = 1.340095640625 = r^t. \text{ And}$$

$1.05$	$\frac{1.05}{105}$	$\frac{1.05}{105}$	$\frac{1.05}{105}$	$\frac{1.05}{105}$	$\frac{1.05}{105}$
$1.340095640625$	$(1.2762815625)$	$(1.21550625)$	$(1.157625)$	$(1.1025)$	$(1.05)$
$105$	$105$	$105$	$105$	$105$	$105$
$290$	$226$	$165$	$107$	$525$	
$\cdot 210$	$210$	$105$	$105$	$525$	
$800$	$162$	$605$	$262$		
$735$	$105$	$525$	$210$		
$659$	$578$	$800$	$525$		
$630$	$525$	$735$	$525$		
$295$	$531$	$656$			
$210$	$525$	$630$			
$856$	$656$	$262$			
$840$	$630$	$210$			
$164$	$262$	$525$			
$105$	$210$	$525$			
$590$	$525$				
$525$	$525$				
$656$					
$630$					
$262$					
$210$					
$525$					
$525$					

Here there were six divisions by 1.05;  
therefore  $t = 6$  years. Ans.

---


$$[2] \quad \frac{u}{p+u-fr} = \frac{30}{133.554672 \text{ \&c.} + 30 - 1.04 \times 133.554672 \text{ \&c.}}$$

$$= \frac{30}{24.657813 \text{ \&c.}} = 1.2166529024 \text{ (nearly)} = r^t. \text{ And}$$

$1.04$	$1.04$	$1.04$	$1.04$	$1.04$
$1.2166529024$	$1.16985856$	$1.124864$	$1.0816$	$1.04$
$104$	$104$	$104$	$104$	$104$
$176$	$129$	$848$	$416$	
$104$	$104$	$832$	$416$	
$726$	$258$	$166$		
$624$	$208$	$104$		
$1035$	$505$	$624$		
$936$	$416$	$624$		
$892$	$898$			
$832$	$832$			
$609$	$665$			
$520$	$624$			
$890$	$416$			
$832$	$416$			
$582$				
$520$				
$624$				
$624$				

Here there were *five* divisions by 1.04; therefore  $t = 5$  years. Ans.

[3]

$$\frac{u}{p+u-pr} = \frac{50}{185.85492 \text{ \&c.} + 50 - 1.03 \times 185.85492 \text{ \&c.}} = \frac{50}{44.42435 \text{ \&c.}} = 1.12550881 \text{ nearly} = r^t. \text{ And}$$

$1.03$	$1.03$	$1.03$
$1.12550881$	$1.092727$	$1.0609$
$103$	$103$	$103$
$955$	$627$	$309$
$927$	$618$	$309$
$280$	$927$	
$206$	$927$	
$748$		
$721$		
$278$		
$206$		
$721$		
$721$		

Here there were *four* divisions by 1.05: therefore  $t = 4$  years. Ans.

$$[4] \quad \frac{u}{p+u-pr} = \frac{70}{243.952418+70-1.0575 \times 243.952418}$$

$$= \frac{70}{55.972736} = 1.2506088687890625 = r^t. \quad \text{And}$$

1.0575	1.2506088687890625	1.0575	1.0575	1.0575
10575	10575	10575	10575	10575
19310	12510	60806		
10575	10575	52875		
87358	19358	79312		
84600	10575	74025		
27588	87838	52875		
21150	84600	52875		
64386	32385			
63450	31725			
93687	66093			
84600	63450			
90878	26437			
84600	21150			
62789	52875			
52875	52875			
99140				
95175				
39656				
31725				
79312				
74025				
52875				
52875				

Here there were four divisions by 1.0575; therefore  
 $t = 4$  years. Ans.

ANNUITIES, LEASES, &c. TAKEN IN REVERSION.

Case 1.

$$\begin{aligned}
 & \text{First, } \frac{ur^t - u}{r^t \times (r - 1)} = \frac{20 \times 1.05^4 - 20}{1.05^4 \times (1.05 - 1)} = \frac{20 \times 1.21550625 - 20}{1.21550625 \times .05} \\
 & \quad \frac{4.310125}{.0607753125} = \text{£} 4.310125 \\
 & \text{Secondly, } \frac{a}{r^t} = \frac{4.310125}{.0607753125 \times 1.05^2} \\
 & \quad \frac{4.310125}{.06700478203125} = 64.325633 \text{ \&c.} = \text{£} 64 \text{ } 6 \text{ } 6 + \text{ Ans.}
 \end{aligned}$$

$$\begin{aligned}
 & \text{First, } \frac{ur^t - u}{r^t \times (r - 1)} = \frac{32 \times 1.05^7 - 32}{1.05^7 \times (1.05 - 1)} = \frac{32 \times 1.40710042265625 - 32}{1.40710042265625 \times .05} = \frac{13.027213525}{.0703550211328125} = \text{£} 13.027213525 \\
 & \text{Secondly, } \frac{a}{r^t} = \frac{13.027213525}{.0703550211328125 \times 1.05^6} \\
 & \quad \frac{13.027213525}{.085516967905815673828125} = 152.334838 + = \text{£} 152 \text{ } 6 \text{ } 8 \frac{1}{2} + \text{ Ans.}
 \end{aligned}$$

$$\begin{aligned}
 & \text{First, } \frac{ur^t - u}{r^t \times (r - 1)} = \frac{100 \times 1.04^8 - 100}{1.04^8 \times (1.04 - 1)} = \frac{100 \times 1.3685690504052736 - 100}{1.3685690504052736 \times .04} = \frac{36.85690504052736}{.054742762016210944} \\
 & \text{Secondly, } \frac{a}{r^t} = \frac{36.85690504052736}{.054742762016210944 \times 1.04^2} \\
 & \quad \frac{36.85690504052736}{.0592097713967337570304} = 622.48011 + = \text{£} 622 \text{ } 9 \text{ } 7.2 + \text{ Ans.}
 \end{aligned}$$

## Case 2.

NOTE 1.  $rt$  is taken from Case 1.

NOTE 2. As  $r$  cannot be exactly expressed in decimals, the answer will not be obtained without a remainder.

$$[1] \text{ First, } prt = 64.325633\&c. \times 1.05^2 = 70.91901\&c. = a.$$

$$\text{Secondly, } \frac{prt \times r - 1}{r^t - 1} = \frac{70.91901 \times 1.05^4 \times .05}{1.05^4 - 1} = \frac{4.310105\&c.}{.21550625} \\ = \text{£ } 20. \text{ Ans.}$$

$$[2] \text{ First, } prt = 152.334838\&c. \times 1.05^4 = 185.163947\&c.$$

$$= a. \text{ Secondly, } \frac{prt \times r - 1}{r^t - 1} = \frac{185.163947 \times 1.05^7 \times .05}{1.05^7 - 1} = \\ 13.0272134\&c. \\ \text{—————} = \text{£ } 32. \text{ Ans.} \\ .40710042265625$$

$$[3] \text{ First, } prt = 622.48011\&c. \times 1.04^2 = 673.27449\&c.$$

$$= a. \text{ Secondly, } \frac{prt \times r - 1}{r - 1} = \frac{673.27449 \times 1.04^3 \times .04}{1.04^3 - 1} = \\ 36.8569056\&c. \\ \text{—————} = \text{£ } 100. \text{ Ans.} \\ .368569054\&c.$$

## Case 3.

$$[1] \text{ } prt = 64.325633\&c. \times 1.05^2 = 70.91909\&c. = a.$$

$$\text{Secondly, } \frac{u}{p + u - pr} = \frac{20}{70.91901 + 20 - 1.05 \times 70.91901} \\ \frac{20}{16.45405\&c.} = 1.21550625 = rt. \text{ And}$$



	1.05	1.05	1.05
1.05)1.21550625	(1.157625	(1.1025	(1.05(1
105	105	105	105
<hr/>	<hr/>	<hr/>	
165	107	525	
105	105	525	
<hr/>	<hr/>		
606	262		
525	210		
<hr/>	<hr/>		
800	525		
735	525		
<hr/>			
656			
630			
<hr/>			
262			
210			
<hr/>			
525			
525			

Here there were *four* divisions by 1.05; therefore  $t = 4$  years. Ans.

[2]

First,  $prt = 152.334838\&c. \times 1.05^4 = 185.163947\&c. = a.$

Secondly,  $\frac{a}{n} = \frac{32}{185.163947 + 32 - 1.05 \times 185.163947}$   
 $\frac{32}{22.741803\&c.} = 1.40710042265625 = r^t.$  And





## PURCHASING REAL OR FREEHOLD ESTATES.

Case 1.

$$[1] \quad \frac{u}{r-1} = \frac{40}{1.05-1} = \frac{40}{.05} = £800. \quad \text{Ans.}$$


---

$$[2] \quad \frac{u}{r-1} = \frac{290}{1.04-1} = \frac{290}{.04} = £7250. \quad \text{Ans.}$$


---

Case 2.

$$[1] \quad p \times r - 1 = 800 \times 1.05 - 1 = 800 \times .05 = £40. \quad \text{Ans.}$$


---

$$[2] \quad p \times r - 1 = 7250 \times 1.04 - 1 = 7250 \times .04 = £290. \quad \text{Ans.}$$


---

Case 3.

$$[1] \quad \frac{p+u}{p} = \frac{800+40}{800} = \frac{840}{800} = 1.05, \text{ or } 5 \text{ per cent.} \quad \text{Ans.}$$


---

$$[2] \quad \frac{p+u}{p} = \frac{7250+290}{7250} = \frac{7540}{7250} = 1.04, \text{ or } 4 \text{ per ct.} \quad \text{Ans.}$$


---

## PURCHASING FREEHOLD ESTATES IN REVERSION.

Case 1.

$$[1] \quad \text{First, } \frac{u}{r-1} = \frac{40}{1.05-1} = \frac{40}{.05} = 800 = p. \quad \text{Secondly,}$$

$$\frac{a}{r^t} = \frac{800}{1.05^5} = \frac{800}{1.157625} = 691.97016 \&c. = £691 \ 1 \ 4\frac{3}{4}+. \quad \text{Ans.}$$


---

$$[2] \quad \text{First, } \frac{u}{r-1} = \frac{290}{1.04-1} = \frac{290}{.04} = 7250 = p. \quad \text{Secondly, } \frac{a}{r^t}$$

$$= \frac{7250}{1.04^4} = \frac{7250}{1.16985856} = 6197.3303846 \&c. = £6197 \ 6 \ 7\frac{1}{4}+. \quad \text{Ans.}$$

Case 2.

- [1] First,  $prt = 691.07016\&c. \times 1.05^3 = 800 = a$ .  
 Secondly,  $p \times r - 1 = 800 \times .05 = £ 40$ . Ans.

- [2] First,  $prt = 6197.3303846\&c. \times 1.04^4 = 7250 = a$ .  
 Secondly,  $p \times r - 1 = 7250 \times .04 = £ 290$ . Ans.

REBATE OR DISCOUNT.

Case 1.

- |    |           |           |
|----|-----------|-----------|
| 4  | 2.        |           |
| 12 | 7.5       |           |
| 20 | 18.625    |           |
| s  | 520.93125 | 520.93125 |
- [1]  $\frac{s}{rt} = \frac{520.93125}{1.05^3} = \frac{520.93125}{1.157625} = £ 450$ . Ans.

- |    |            |            |
|----|------------|------------|
| 4  | 3.         |            |
| 12 | 9.75       |            |
| 20 | 19.8.25    |            |
| s  | 504.990625 | 504.990625 |
- [2]  $\frac{s}{rt} = \frac{504.990625}{1.06^4} = \frac{504.990625}{1.26247696} = £ 400$  nearly. An.

- |    |               |              |
|----|---------------|--------------|
| 12 | 11            |              |
| 20 | 4.916666&c    |              |
| s  | 643.245833&c. | 643.24583333 |
- [3]  $\frac{s}{rt} = \frac{643.245833\&c.}{1.05^6} = \frac{643.24583333}{1.340095640625} = £ 480$  nearly. Ans.

Case 2.

- [1]  $prt = 450 \times 1.05^3 = 450 \times 1.157625 = 520.93125$   
 $= £ 520$  18 7½. Ans.

- [2]  $prt = 400 \times 1.06^4 = 400 \times 1.26247696 = 504.990784$   
 $= £ 504$  19 9¾. Ans.

- [3]  $prt = 480 \times 1.05^6 = 480 \times 1.340095640625 =$   
 $643.2459075 = £ 643$  4 11. Ans.

## Case 3.

$$[1] \quad \frac{s}{P} = \frac{520.93125}{450} = 1.157625 = r^t. \quad \text{And}$$

$$1.05)1.157625(\frac{1.05}{105}(\frac{1.05}{105}(\frac{1.05}{105}(1$$

$$\begin{array}{r} 107 \\ 105 \end{array} \quad \begin{array}{r} 525 \\ 525 \end{array}$$

$$\begin{array}{r} 262 \\ 210 \end{array}$$

Here there were *three* divisions by 1.05 ; therefore  $t = 3$  years. Ans.

$$[2] \quad \frac{s}{P} = \frac{504.990784}{400} = 1.26247696 = r^t. \quad \text{And}$$

$$1.06)1.26247696(\frac{1.06}{106}(\frac{1.06}{106}(\frac{1.06}{106}(\frac{1.06}{106}(1$$

$$\begin{array}{r} 202 \\ 106 \end{array} \quad \begin{array}{r} 131 \\ 106 \end{array} \quad \begin{array}{r} 636 \\ 636 \end{array}$$

$$\begin{array}{r} 964 \\ 954 \end{array} \quad \begin{array}{r} 250 \\ 212 \end{array}$$

$$\begin{array}{r} 107 \\ 106 \end{array} \quad \begin{array}{r} 381 \\ 318 \end{array}$$

$$\begin{array}{r} 169 \\ 106 \end{array} \quad \begin{array}{r} 636 \\ 636 \end{array}$$

$$\begin{array}{r} 636 \\ 636 \end{array}$$

Here there were *four* divisions by 1.06 ; therefore  $t = 4$  years. Ans.

$$[3] \quad \frac{s}{p} = \frac{643.2459075}{480} = 1.340095640625 = r^t. \text{ And}$$

1.05	1.05	1.05	1.05	1.05
1.340095640625	1.2762815625	1.1550625	1.157625	1.1025
105	105	105	105	105
290	226	165	107	525
210	210	105	105	525
800	162	605	262	
735	105	525	210	
659	578	800	525	
630	525	735	525	
295	531	656		
210	525	630		
856	656	262		
840	630	210		
164	262	525		
105	210	525		
590	525			
525	525			
656				
630				
262				
210				
525				
525				

Here there were six divisions by 1.05; therefore  $t = 6$  years. Ans.

Case 4.

$$[1] \quad \frac{s}{p} = \frac{520.95125}{450} = 1.157625 = r^t = r^3. \text{ And by ex-}$$

tracting the 3d or cube root of 1.157625, it will be found to be 1.05 or 5 per cent. Ans.

$$[2] \quad \frac{s}{p} = \frac{504.990784}{400} = 1.26247696 = r^t = r^4. \text{ And by}$$

extracting the 4th root of 1.26247696, it will be found that  $r = 1.06$  or 6 per cent. Ans.

$$[3] \quad \frac{s}{p} = \frac{643.2459075}{480} = 1.340095640625 = r^t = r^6.$$

And by extracting the 6th root of 1.340095640625, it will be found  $= 1.05$  or 5 per cent. Ans.

# A KEY TO DILWORTH'S ARITHMETIC.

## PART IV.

### A COLLECTION OF QUESTIONS TO EXERCISE THE FOREGOING RULES.

[1] 900760021. Ans.

[2]

£.	s.	d.	£	s.	d.	s.
326	6	8	:	41	16	2 :: 20
20				20		
<hr/>						
6526				836		
12				12		
<hr/>						
78320				10034		
				20		

78320)200680(2 6½ +  $\frac{77600}{78320}$

156640 [Ans.]

44040

12

528180

469920

58560

4

234240

156640

77600

78320

[3]  $\frac{1}{3}$  of 6 : 3 ::  $\frac{1}{4}$  of 20

2 : 3 :: 5

3

3)15

Ans. 7½

[4] 1748.

1748

3496 Ans.

[5] 76

76

456

532

5776 Ans.

[6] 4)14676

3669

11007 Ans.

[7] 476

476

2856

3332

2)476 | 1904

238 | 226576 (952 An.

2142

1237

1190

476

476



$$\begin{array}{r}
 [8] \quad 14687. \\
 \hline
 1st. \quad 461 \\
 2nd. \quad 581 \\
 \hline
 1042 \\
 \hline
 3d. \quad 426 \quad \text{Ans.}
 \end{array}$$

$$\begin{array}{r}
 [9] \quad 13)221(17 \quad \text{Ans.} \\
 \underline{13} \\
 91 \\
 \underline{91} \\
 0
 \end{array}$$

$$\begin{array}{r}
 [10] \\
 A's \text{ debt} \quad 2173\frac{1}{2} \\
 \text{Difference} \quad 374 \\
 \hline
 B's \text{ debt} \quad 2544 \quad \text{Ans.}
 \end{array}$$

$$\begin{array}{r}
 [11] \\
 5)1360 \\
 \underline{272} \text{ the Captain's share.} \\
 160)1088(6\frac{1}{2} \text{ a Soldier's} \\
 \underline{960} \quad \text{share.} \\
 128 \\
 \underline{20} \\
 2560 \\
 \underline{160} \\
 960 \\
 \underline{960} \\
 0
 \end{array}$$

$$\begin{array}{r}
 [12] \quad 19 \\
 8 \times 3 = 24 \\
 \underline{19} \\
 62 \quad \text{Ans.}
 \end{array}$$

$$\begin{array}{r}
 [13] \quad 341 \\
 \underline{726} \\
 1067 \quad \text{Ans.}
 \end{array}$$

$$\begin{array}{r}
 [14] \quad 706 \\
 \underline{168} \\
 538 \quad \text{Ans.}
 \end{array}$$

$$\begin{array}{r}
 [15] \quad 72 \\
 \underline{19} \\
 648 \\
 \underline{72} \\
 1368 \quad \text{Ans.}
 \end{array}$$

$$\begin{array}{r}
 [16] \quad 650\frac{1}{2} \\
 \underline{130} \\
 100 : 520 :: 400 \\
 \underline{400} \\
 1,00)2080,00 \\
 \underline{\pounds 2080} \quad \text{Ans.}
 \end{array}$$

$$\begin{array}{r}
 [17] \quad 4139 \\
 \underline{948} \\
 3191 \quad \text{Ans.}
 \end{array}$$

$$\begin{array}{r}
 [18] \quad 17\frac{1}{2} \\
 \underline{8} \\
 46 \\
 2 \times 20 = 40 \\
 \underline{111} \quad \text{Ans.}
 \end{array}$$

[19]

*B B C*

4 : 7 :: 6

7

4)42

*l. s.*10*l.* 10*s.*

A 5 0

B 7 0

C 10 10

22 10 : 5 :: 120

20 20

450 100

120

*£. s. d.*450)12000(26 13 4 A's  
900 share.

3000

2700

300

20

6000

450

1500

1350

150

12

1800

1800

*l. s. £. s.*

22 10 : 7 :: 120

20

20

450

140

120

*£. s. d.*450)16800(37 6 8 B's  
1350 share.

3300

3150

150

20

3000

2700

300

12

3600

3600

*£. s.**£. s.**£.*

22 10 : 10 10 :: 120

20

20

450

210

120

*£.*450)25200(56 C's share.  
2250

2700

2700

$$\begin{array}{r}
 [20] \quad 212 \\
 \quad 38 \\
 1342 \quad \text{---} \\
 1178 \quad 424 \\
 630 \quad 636 \\
 \text{---} \quad \text{---} \quad \text{£.} \\
 3150 : 6784 :: 1342 \\
 \quad 1342 \\
 \text{---} \\
 \quad 13568 \\
 \quad 27136 \\
 \quad 20352 \\
 \quad 6784 \\
 \text{---} \quad \text{£.} \quad \text{s.} \quad \text{d.} \\
 3150)9104128(2890 \quad 3 \quad 11\frac{1}{2} \\
 \quad 6300 \quad + \frac{1230}{3150} \text{ A.} \\
 \text{---} \\
 \quad 28041 \\
 \quad 25200 \\
 \text{---} \\
 \quad 28412 \\
 \quad 28350 \\
 \text{---} \\
 \quad 628 \\
 \quad 20 \\
 \text{---} \\
 \quad 12560 \\
 \quad 9450 \\
 \text{---} \\
 \quad 3110 \\
 \quad 12 \\
 \text{---} \\
 \quad 37320 \\
 \quad 34650 \\
 \text{---} \\
 \quad 2670 \\
 \quad 4 \\
 \text{---} \\
 \quad 10680 \\
 \quad 9450 \\
 \text{---} \\
 \quad 1118 \\
 \quad 3150
 \end{array}$$

$$\begin{array}{r}
 \text{L.} \quad \text{L.} \quad \text{L.} \\
 3150 : 6784 :: 1178 \\
 \quad 1178 \\
 \text{---} \\
 \quad 54272 \\
 \quad 47488 \\
 \quad 74624 \\
 \text{---} \quad \text{L.} \\
 3150)7991552(2537 \frac{2}{3} \text{ B.} \\
 \quad 6300 \\
 \text{---} \\
 \quad 16915 \\
 \quad 15750 \\
 \text{---} \\
 \quad 11655 \\
 \quad 9450 \\
 \text{---} \\
 \quad 22052 \\
 \quad 22050 \\
 \text{---} \\
 \quad 3150 \frac{2}{3} \\
 \text{---} \\
 \text{L.} \quad \text{L.} \quad \text{L.} \\
 3150 : 6784 :: 630 \\
 \quad 630 \\
 \text{---} \\
 \quad 203520 \\
 \quad 40704 \quad \text{£.} \quad \text{s.} \\
 3150)4273920(1356 \quad 16 \text{ C.} \\
 \quad 3150 \\
 \text{---} \\
 \quad 11239 \\
 \quad 9450 \\
 \text{---} \\
 \quad 17892 \\
 \quad 15750 \\
 \text{---} \\
 \quad 21420 \\
 \quad 18900 \\
 \text{---} \\
 \quad 2520 \\
 \quad 20 \\
 \text{---} \\
 \quad 50400 \\
 \quad 3150 \\
 \text{---} \\
 \quad 18900 \\
 \quad 18900
 \end{array}$$

[21]

A 409

B 198

---

607

---

1000

L. C 393 L.  
 1000 : 1964 :: 409  
 409

---

17676

---

7856

---

1,000)803,276

---

803*l.* 5*s.* 6*d.*  $\frac{249}{1000}$  A.

L. L. L.  
 1000 : 1964 :: 198  
 198

---

15712

---

17676

---

1964

---

1,000)388,872

---

388*l.* 17*s.* 5*d.*  $\frac{289}{1000}$  B.

L. L. L.  
 1000 : 1964 :: 393  
 393

---

5892

---

17676

---

5892

---

1,000)771,852

---

771*l.* 17*s.* 0*d.*  $\frac{489}{1000}$  C.

[22]

£.

3)369

---

123 = A's loss.

£.

3)897

---

299 = B's loss.

£.

3696

---

369

---

897

---

1266

---

3)2430

---

810 = C's loss.

[23]

£.

£.

£.

4,0 : 6,0 :: 640

---

6

---

4)3840

---

£ 960 Ans.

[24]

Doz. lb.

27 10

---

12

---

334

---

5

---

12)1670

---

20)13,9 2

---

£ 6 19 2 Ans.

# COLLECTION OF QUESTIONS.

277

[25]

gr. bu.

28 2

8

s. d.

4 0 |  $\frac{1}{8}$  | 226 at 4s. 6d.

6 |  $\frac{1}{8}$  | 45 4

5 13

£ 50 17 Ans.

[26]

19

6

s. d.

2 6 |  $\frac{1}{8}$  | 114 at 2s. 6 $\frac{1}{2}$ d.

$\frac{1}{8}$  |  $\frac{1}{80}$  | 14 5

0 4 9

£ 14 9 9 Ans.

1000

[27]

350

400

750

250 C's share

l. l. l.

250 : 350 :: 500

500

250)175000(700. A's stock.

1750

00

l. l. l.

250 : 400 :: 500

500

l.

250)200000(800 = the price  
2000 of B's cloth

00

[28]

C. gr. lb.

No. 1, - 3 3 20

2, - 3 2 26

3, - 3 0 24

4, - 3 3 00

5, - 2 2 22

6, - 2 2 26

76 $\frac{3}{4}$  lb.  $\times 3 =$  2 0 61 $\frac{1}{4}$

62 $\frac{1}{4}$  lb.  $\times 2 =$  1 0 12 $\frac{1}{2}$

Ans. 23 0 24 $\frac{3}{4}$

s. d. du. l. s. [29]

4 4 : 1 :: 178 2

12 20

52 3562

12

duc.

52)42744(822 Ans.

416

114

104

104

104

[30]

s. d.

4 |  $\frac{1}{3}$  | 500 at 4 5 $\frac{1}{2}$

4

2000

166 8

62 6

11 $\frac{1}{2}$

2,0 222,9 2

111l. 9s. 2d. Ans.

[31]

$$\begin{array}{r} l. \quad s. \quad d. \\ 7,43 \quad 17 \quad 3 \\ \underline{20} \end{array}$$

8,77

12

9,27

4

1,08

Ans. 7l. 8s.  $9\frac{1}{4}d. + \frac{8}{100}$ 

s. d.

$$6 \quad 8 = \frac{1}{3} \mid$$

[32] s. d.

720 at 6 8

240l. the value of  
the duc.

100

40

$$40 : 60 :: 240$$

60

$$4,0) 1440,0$$

360l. = A's stock.

[33]

$$5 : 3 :: 640$$

3

$$5) 1920$$

384l. Ans.

[34]

$$\frac{3}{4} \div \frac{15}{1} = \frac{3}{4} \times \frac{1}{15} = \frac{3}{60} = \frac{1}{20} \text{ Ans.}$$

[35]

$$\frac{5}{8} \text{ of } 20 = \frac{5 \times 20}{8} s = \frac{100}{8} s = 12s. 6d. \text{ Ans.}$$

[36]

$$\frac{5}{6} - \frac{2}{3} = \frac{5 \times 5}{6 \times 5} - \frac{2 \times 6}{5 \times 6} = \frac{25}{30} - \frac{12}{30} = \frac{13}{30} \text{ Ans.}$$

[37]

$$12\frac{1}{4} - 7\frac{2}{3} = \frac{49}{4} - \frac{23}{3} = \frac{49 \times 3}{4 \times 3} - \frac{23 \times 4}{3 \times 4} = \frac{147}{12} - \frac{92}{12}$$

92

55

12

12

$$= 4\frac{7}{12} \text{ Ans.}$$

[38]

$$\frac{3}{8} + \frac{1}{8} = \frac{3 \times 8}{5 \times 8} + \frac{1 \times 5}{8 \times 5} = \frac{24}{40} + \frac{5}{40} = \frac{29}{40} \text{ Ans.}$$

[39]

$$13\frac{1}{2} + 5\frac{5}{7} = \frac{27}{2} + \frac{40}{7} = \frac{27 \times 7}{2 \times 7} + \frac{40 \times 2}{7 \times 2} = \frac{189}{14} + \frac{269}{14}$$

$$+ \frac{80}{14} = \frac{269}{14} = 19\frac{3}{14} \text{ Ans.}$$

$$[40] \quad \frac{21}{1} \times \frac{3}{4} = \frac{63}{4} = 15\frac{3}{4} \text{ Ans.}$$

$$[41] \quad \frac{1}{4} \div \frac{2}{5} = \frac{1}{4} \times \frac{5}{2} = \frac{5}{8} \text{ Ans.}$$

$$[42] \quad \frac{5}{3} - \frac{2}{3} = \frac{3}{3}; \text{ and } \frac{3}{5} : \frac{5}{6} :: 12 : \frac{12 \times 5 \times 5}{1 \times 5 \times 3} = \frac{4 \times 5}{1} = 20 \text{ Ans.}$$

$$[43] \quad \frac{1}{5} \div \frac{2}{3} = \frac{1}{5} \times \frac{3}{2} = \frac{3}{10} \text{ Ans.}$$

$$[44] \quad 1 + \frac{2}{5} = \frac{7}{5}; \text{ and } 5 : 3 :: 20$$

$$\begin{array}{r} 20 \\ - \\ 5)60 \\ - \\ 12 \text{ Ans.} \end{array}$$

$$[45] \quad \frac{2}{3} : \frac{3}{3} :: 9 : \frac{9 \times 3 \times 3}{1 \times 3 \times 2} = \frac{27}{2} = 13\frac{1}{2} \text{ Ans.}$$

[46]	C. gr. lb.	sh.	l.	l.
	7 3 17	3 sh.	3740	3740 × 8
	4	[47]	- : 1 ::	- : -
	—		8	1 1 × 3
	31		l.	
	28		29920	
	—		= — =	9973l. 6s. 8d.
	265		3	Ans.
	2)6)62			
	—			
	3)885			
	—			
	295 Ans.			

[48]  $\frac{2}{3} : \frac{3}{3} :: \frac{210}{1} : \frac{210 \times \frac{1}{3} \times 3}{1 \times 3 \times 2} = 315\%$  the elder brother's portion. And

$$\begin{array}{r} 315 \\ 3 \\ \hline 945 \\ 2 \\ \hline 1890\% \text{ Ans.} \end{array}$$

<p>5 : 9 :: 50 9</p> <hr/> <p>5)450</p> <hr/> <p>s. 90 yds: the qt. of 18 drug.</p> <hr/> <p>50</p> <hr/> <p>20)90,0</p> <hr/> <p>£45 price of the cloth. 81</p> <hr/> <p>36 price of the drug. 20</p> <hr/> <p>9,0)72,0</p> <hr/> <p>8s. price of the drugget per yard.</p> <hr/> <p>[50] <math>\begin{array}{r} l. \ s. \\ 95 \ 8 \\ 90 \ 0 \end{array}</math></p> <hr/> <p>£. <math>\begin{array}{r} 9,9 : 5 \ 8 :: 10,0 \\ 10 \end{array}</math> £.</p> <hr/> <p>9)54 0</p> <hr/> <p>6 pr. cent. Ans.</p>	<p>[49] Miles. [51]</p> <p>7</p> <p>18</p> <p>18 dist. the 1st day.</p> <p>12</p> <hr/> <p>216 Ans.</p> <hr/> <p>l. [52]</p> <p>100 l.</p> <p>12 8)400</p> <hr/> <p>88 : 100 :: 50</p> <p>50</p> <p>88)5000</p> <hr/> <p>11) 625</p> <hr/> <p>[cost per ton.</p> <p>56l. 16s. <math>4\frac{1}{4} + \frac{5}{11}d.</math></p> <p>T. l. gal.</p> <p>1 : 50 :: 1</p> <p>4 20</p> <hr/> <p>s. d.</p> <p>4 252)1000 (<math>3 \ 11\frac{1}{2} + \frac{120}{11}</math></p> <p>63 756 sold at pr. gal.</p> <hr/> <p>252 244</p> <hr/> <p>12</p> <hr/> <p>2928</p> <hr/> <p>2772</p> <hr/> <p>156</p> <hr/> <p>4</p> <hr/> <p>624</p> <hr/> <p>504</p> <hr/> <p><math>\frac{120}{11}</math></p>
---	--



*M.* [53] *lb. l. s. d. oz.*  
 17 112 : 59 14 8 :: 1  
 12 16 20

5 dist. the 1st day. 672 1194  
 10 112 12

50 Ans. 1792)14336(8 price of 1 nut.  
 14336

*l.* [54]

1000 *oz. d.*  
 63 1 8  
 1 8

*Da.* — *Da.*

365 : 937 :: 1  
 1 2 : 16 :: 3  
 3

*l. s. d.*

365)937(2 11 4 <sup>40</sup>/<sub>365</sub> Ans. 2)48

730

24 = 2s. Ans.

207

20

[56] *Cgr. lb.*

17 3 10

16 0 14

4140

4015

*C.gr.lb.* — *lb.*

17 3 10 : 1 2 24 :: 1

125

4

4

12

71

6

1500

28

28

1460

578

192

40

142

16

[55]

*lb. l. s. d. oz.*

76 : 40 10 8 :: 1

16 20

1998 )3072(1 8 <sup>1200</sup>/<sub>1998</sub> loss  
 1998 [pr. lb.

1074

16

456 810

76 12

17184

15984

*d. oz.*

1200

1998

1216)9728(8 price of 1 cinn.  
 9728

$$8\frac{6}{7} + 1\frac{1}{2} = 8\frac{4}{3} + 1\frac{1}{2} = 9\frac{8}{3} \quad [58]$$

$$= 10\frac{2}{3} \text{ cost p. lb. } 1998 \times 10\frac{2}{3}$$

$$1998 \times 587 \quad 1172826$$

$$= \text{-----} = \text{-----}$$

$$56 \quad 56$$

$$12$$

$$56)1172826 (20943$$

$$112 \quad \text{-----}$$

$$\text{-----} 2,0)174,5 \ 3$$

$$528$$

$$504 \quad \text{£ } 87 \ 5 \ 3\frac{1}{4} + \frac{16}{8}$$

Ans.

$$242$$

$$224$$

$$186$$

$$168$$

$$18$$

$$4$$

$$72(1$$

$$56$$

$$16$$

$$48$$

$$[57] \quad C. \text{ gr. lb.}$$

$$3 \ 1 \ 10$$

$$25$$

$$3 \ 0 \ 13$$

$$3$$

$$9 \ 1 \ 11$$

$$4$$

$$37$$

$$28$$

$$307$$

$$74$$

$$1047$$

$$4$$

$$12)4188$$

$$2,0)34,9$$

$$\text{£. } 17 \ 9s. \quad \text{Ans.}$$

$$10 \text{ Tons.}$$

$$4$$

$$40 \text{ hhds.}$$

$$63$$

$$2,0)252.0$$

$$126 \text{ Custom.}$$

$$l. \quad 5 \text{ Cartage.}$$

$$40 \times 10 = 400$$

$$531 \text{ prime cost.}$$

$$40 \text{ Hhds.}$$

$$2 \text{ lost.}$$

$$38$$

$$17$$

$$266$$

$$38$$

$$646$$

$$531$$

$$\text{Ans. } 115l. \text{ Gain.}$$

$$6 \times 5 \times 40 = 1200$$

$$[59]$$

$$12 \times 5 \times 30 = 1800$$

$$84 \times 3 \times 22 = 5544$$

$$8544 : 1200 :: 300$$

$$300 \text{ l. s. d.}$$

$$8544)360000(42 \ 2 \ 8\frac{1}{2}$$

$$34176$$

$$18240$$

$$17088$$

$$1152$$

$$20$$

$$23040$$

$$17088$$

$$5952$$

$$12$$

$$71424$$

$$68352$$

$$3072$$

$$5$$

$$12288$$

$$8544$$

$$3744$$

$$l. \ s. \ d.$$

$$6)42 \ 2 \ 8\frac{1}{2} + \frac{3744}{8544} \text{ all the officers.}$$

$$7 \ 0 \ 5\frac{1}{4} + \quad \text{each officer.}$$

8544 ; 1800 :: 300  
300

£. s. d.  
 8544)540000(63 4 0½  
 51264

27360  
 25632

1738  
 20

34560  
 34176

384  
 12

4608  
 4

18432  
 17088

1344

£. s. d. [midshipmen.  
 12)63 4 0½ + 1344 all the  
 5 5 4 + each midship.

8544 : 5544 :: 300.  
300

£. s. d.  
 8544)1663200(194 13 3  
 8544

80880  
 76896

39840  
 34176

5664  
 20

113280

113280  
 8544

27840  
 25632

2208  
 12

26496  
 25632

864

£. s. d. [ors.  
 84)194 13 3 <sup>864</sup>/<sub>8544</sub> all the sail-  
 188 (2l. 1s. 7d. each  
 sailor.

6  
 20

133  
 84

49  
 12

591  
 588

3

[60] d. lb. d.  
 8 : 1000 :: 70  
 70

8)7000  
 8750



$$100\frac{10}{3} \div 100 :: 350 : \frac{350 \times 100 \times 3}{310} = \frac{10500}{31} \text{ And}$$

$$\frac{21000}{61} + \frac{10500}{31} = \frac{651000}{1891} + \frac{640500}{1891} = \frac{1291500}{1891} : \text{or}$$

$$\begin{array}{r} \text{£. s. d.} \\ 1891 \overline{) 1291500} \quad (682 \text{ 19 } 5\frac{1}{2} + \\ \underline{11346} \quad \quad \quad \underline{177} \text{ Ans.} \end{array}$$

$$\begin{array}{r} 15690 \\ 15128 \\ \hline \end{array}$$

$$\begin{array}{r} 5620 \\ 3782 \\ \hline \end{array}$$

$$\begin{array}{r} 1838 \\ 20 \\ \hline \end{array}$$

$$\begin{array}{r} 36760 \\ 1891 \\ \hline \end{array}$$

$$\begin{array}{r} 17850 \\ 17019 \\ \hline \end{array}$$

$$\begin{array}{r} 831 \\ \hline \end{array}$$

$$\begin{array}{r} 9972 \\ 9455 \\ \hline \end{array}$$

$$\begin{array}{r} 517 \\ 4 \\ \hline \end{array}$$

$$\begin{array}{r} 2068 \\ 1891 \\ \hline \end{array}$$

$$\begin{array}{r} 177 \\ 1891 \end{array}$$

$$\begin{array}{r} [63] \quad 12 \\ 400 \\ \hline \end{array}$$

$$\begin{array}{r} 2) 4800 \\ \hline \end{array}$$

$$\begin{array}{r} 3,0) 240,0 \\ \hline \end{array}$$

80 tons wine.

$$\begin{array}{r} 2400 \\ 20 \\ \hline \end{array}$$

$$\begin{array}{r} 28) 48000 \\ \hline \end{array}$$

$$\begin{array}{r} 7) 12000 \\ \hline \end{array}$$

Rice 1714 C. 1 gr. 4 lb.

	[64]			lb. oz.	d.
20	12	4 = 4	26 : 4 :: 112 : 17	$31\frac{8}{56}$	at 12
	16	4 = 4	26 : 4 :: 112 : 17	$3\frac{4}{56}$	at 16
	18	4 = 4	26 : 4 :: 112 : 17	$3\frac{18}{56}$	at 18
	24	8 + 4 + 2 = 14	26 : 14 :: 112 : 60	$4\frac{24}{56}$	at 24

26

d.	[65]		31.5
17 at 8 = 136			63
19 at 10 = 190			—
40 at 6 = 240			945
—			1890
76	12)566		—
	2,0)4,7 2		1984.5
	[price.		31.5
d. £. 2 7 2 whole			63
76)566(7 + $\frac{40}{76}$ per gallon.			—
532			94.5
—			[duct and sum.
34	[66] 96		1890 Diff. of their pro-
4	48		
—	—		
136	144 Sum.		25 × 25 = 625. And [68]
76	48 Diff.		625 <sup>2</sup> = 390625
—	—		25 <sup>2</sup> = 625
60	96 Ans.		391250(625.499 + A.
76	—		36
2)63	[67]		122   312
—	—		2   244
31.5 and 63 are the Nos.			1245   6850
31.5	63		5   6225
—	—		12504   62500
1575	189		4   59016
315	378		—
945	—		125089   1248400
—	3969		9   1125801
992.25	—		—
	992.25		1250989   12269900
	3969		—
	893025		11258901
	595350		—
	893025		1010999
	297675		
3938240.25	[their squa.		
	Product of		

# COLLECTION OF QUESTIONS.

987

[69]

46)1058 (23 Multiplier.		1058
92	46	1058
—	—	—
138	69 Sum of the fac.	8464
138		5290
		1058
		—
46	23	1119364
46	23	—
—	—	97336
276	69	12167
184	46	—
—	—	109503
2116	529	—
46	23	1009861 difference.
—	—	—
12690	1587	
8464	1058	
—	—	
97336	12167	

[70]

			1216
			1216
76)1216(16 divisor.	16	76	—
76	16	76	7296
—	—	—	1216
456	96	456	14592
456	16	532	—
—	—	—	1478656
1478656	256	5776	1216
256	16	76	—
—	—	—	8871936
1478912	1536	34656	1478656
438976	256	40432	17743872
—	—	—	—
1039936 differ.	4096	438976	1798045696

$$1798045696$$

$$438976$$

$$4096$$

$$\overline{1798488768} (1216 + \text{cube root.})$$

$$\overline{1}$$

$$1^2 \times 3 = )7$$

$$12^3 = 1728$$

$$12^2 \times 3 = 432)704$$

$$121^3 = 1771561$$

$$121^2 \times 3 = 43923)269277$$

$$1216^3 = 1798045696$$

$$443072 \text{ Rem.}$$

[71]

34

2

*d. h. m.*68)2000(29 9 52 $\frac{44}{3}$  Ans.

136

640

612

28

24

112

56

672

672

612

60

60

3600

340

200

136

44



A 20  
B 19  
C 9  
D 9  
E 1  
F 1

[72]

*l. s.*

59 : 19 :: 700 13  
19

*l. s. d.*

59)13312 7(225 12 7 $\frac{3}{4}$   
118 +  $\frac{43}{59}$  B.

*l. s.*

59 : 20 :: 700 13  
20

*l. s. d. gr.*

59)14013 0(237 10 20 +  $\frac{8}{59}$  A.  
118

151  
118

332  
295

221  
177

37  
20

448  
413

747  
59

30  
20

157  
118

600  
590

39  
12

10  
12

468  
413

120  
118

55  
4

2  
4  
8

220  
177  
49

$\begin{array}{r} \text{£. s.} \\ 59 : 9 :: 700 \text{ } 13 \\ \hline 9 \\ \hline 59)6305 \text{ } 17(106 \text{ } 17 \text{ } 6\frac{1}{2} \\ \hline 59 \\ \hline 405 \\ \hline 354 \\ \hline 51 \\ \hline 20 \\ \hline 1037 \\ \hline 59 \\ \hline 447 \\ \hline 413 \\ \hline 34 \\ \hline 12 \\ \hline 408 \\ \hline 354 \\ \hline 54 \\ \hline 4 \\ \hline 216 \\ \hline 177 \\ \hline 39 \\ \hline 59 \end{array}$	$\begin{array}{r} \text{£. s. d.} \\ 59 : 1 :: 700 \text{ } 13 \\ \hline 1 \\ \hline 59)700 \text{ } 13(11 \text{ } 17 \text{ } 6 \text{ } 0\frac{1}{2} \\ \hline 59 \\ \hline 110 \\ \hline 59 \\ \hline 51 \\ \hline 20 \\ \hline 1033 \\ \hline 59 \\ \hline 443 \\ \hline 413 \\ \hline 30 \\ \hline 12 \\ \hline 360 \\ \hline 354 \\ \hline 6 \\ \hline 4 \\ \hline 24 \\ \hline 59 \end{array}$	$\begin{array}{r} \text{l. s. l. s. d.} \\ 59 : 9 :: 703 \text{ } 13 : 106 \text{ } 17 \text{ } 6\frac{1}{2} + \frac{39}{59} \text{ D.} \\ \hline \text{l. s.} \\ 59 : 1 :: 700 \text{ } 13 \\ \hline 1 \\ \hline \text{l. s. d. q.} \\ 59)700 \text{ } 13(11 \text{ } 17 \text{ } 6 \text{ } 0\frac{1}{2} \\ \hline 59 \\ \hline 110 \\ \hline 59 \\ \hline 51 \\ \hline 20 \\ \hline 1033 \\ \hline 59 \\ \hline 443 \\ \hline 413 \\ \hline 30 \\ \hline 12 \\ \hline 360 \\ \hline 354 \\ \hline 6 \\ \hline 4 \\ \hline 24 \\ \hline 59 \end{array}$
--	--	---

[73]

17

19

48

17

19

48

119

171

384

17

19

192

289

361

19

2304

3249

289

361

6859

2593

2593

4266 Ans.

[74]

C. gr. lb.

1	2	5
		7

---

 10 3 7

4

43

28

---

 351

86

---

 1211

16

oz. dr.

5 7 19376

16 16

---

 87 ) 310016(3563<sup>35</sup>/<sub>17</sub> Ans.

261

---

 490

435

---

 551

522

---

 296

261

---

 35

[75]

<sup>9</sup> <sub>1</sub>  
 81034 × 18 × 4 × 9

---

 = 6563754 bottles;

8

2

1

and

12 | 6563754

---

 12 | 546979 6

---

 Gross 45581 7 doz. 6 bot.

[76]

731 × 12 × 12

 $731 \times 12 \times 1\frac{5}{7} = \frac{\quad}{7}$ 

ft.

105264

---

 = 15037<sup>5</sup>/<sub>7</sub> ft =

7

gal. pts.

1879 5<sup>5</sup>/<sub>7</sub> = 29 hhd. 52 gal. 5<sup>5</sup>/<sub>7</sub> pt.

[77]

<sup>56</sup>  
 17 × 112 × 12

 $8\frac{1}{2} \times 112 \times 12 = \frac{\quad}{2} d$ 

2

11424

1

---

 = d = £47 12s. sterling.

1

s. s. d. £. s.

20 : 33 8 :: 47 12

12 12 20

---

 240 404 952

404

---

 3808

3808

2,0

240) 384608 (160,2 6

240

---

 £80 2 6<sup>96</sup>/<sub>100</sub>

1446

Ans.

---

 1440

608

480

---

 128

12

---

 1536

1440

---

 96



37. [85]

$$\begin{array}{r} 5 \\ 8 \end{array}$$

$$\begin{array}{r} 16 : 3 :: 1000 \\ 3 \end{array}$$

$$16)3000$$

$$\pounds 187 \ 10 \ A.$$

$$16 : 5 :: 1000$$

$$16)5000$$

$$\pounds 312 \ 10 \ B.$$

$$16 : 8 :: 1000$$

$$16)8000$$

$$\pounds 500 \ C.$$

[86]

$$6 \mid \frac{1}{2} \quad 550 \text{ at } 1 \text{ s. } 6 \text{ d.}$$

$$11$$

$$6050$$

$$275$$

$$2,0 \mid 632,5$$

$$\pounds 316 \ 5$$

d.

$$2 \mid \frac{1}{8} \quad 460 \text{ at } 1 \text{ s. } 2 \text{ d.}$$

$$76 \ 8$$

$$2,0 \mid 53,6 \ 8$$

$$\pounds 26 \ 16 \ 8$$

$$316 \ 5 \ 0$$

$$343 \ 1 \ 8$$

$$C. \text{ gr. } 46 \ 3 \text{ at } 1 \ 4 \ 6 \text{ per } C.$$

$$2 \mid \frac{1}{2}$$

$$46$$

$$56 \ 7 \ 0$$

$$12 \ 3$$

$$6 \ 1 \frac{1}{2}$$

$$\pounds 57 \ 5 \ 4 \frac{1}{2}$$

d.

$$4 \mid \frac{2}{3} \quad 1570 \text{ at } 2 \text{ s. } 4 \text{ d.}$$

$$2$$

$$3140$$

$$523 \ 4$$

$$2,0 \mid 366,3 \ 4$$

$$183 \ 3 \ 4$$

$$57 \ 5 \ 4 \frac{1}{2}$$

$$240 \ 8 \ 8 \frac{1}{2}$$

$$343 \ 1 \ 8$$

$$\pounds 102 \ 12 \ 11 \frac{1}{2} \text{ Ans.}$$

[87]

$$l. \ s. \ d.$$

$$d. \ 1 \ 10 \ 0$$

$$40 \text{ at } 4 = 0 \ 13 \ 4$$

$$2 \ 3 \ 4 \text{ price of } 1 \text{ load.}$$

$$43 \ 6 \ 8 \text{ do. } 20 \text{ do.}$$

$$19 \text{ at } 5 \text{ s.} = 4 \ 15 \ 0$$

$$38 \ 11 \ 8 \text{ Ans.}$$

$$\begin{array}{r|l} 3 & \frac{1}{4} \quad 486 \text{ at } 1s. \ 3\frac{1}{4}d. \\ \frac{1}{2} & \frac{1}{8} \quad 121 \ 6 \\ & 20 \ 3 \end{array}$$

---


$$62,7 \ 9$$


---

£ 31 7 9 spent.

---

[97]      90%.

10

*E. F.*    —    *E. E.*

1000 : 100 :: 1

3      5      5

---

3000    500    5

20

---

3,000)10,000

---

3s. 4d.    Ans.

---

[98]

£.

60 × 3 = 180

60 × 4 = 240

£.      £.      £.

180 : 240 :: 240

3 : 4 :: 240

4

---

3)960

---

£ 320    Ans.

---

s. d.

[99]

1 at 4 0

1 at 4 6

1 at 5 0

---

3.) 13 6

---

4 6    Ans.

[100]

G.    st.

4000 15

20

---

80015

2

16 : 9 :: 160030

9

---

16)1440270

---

12)900161 $\frac{1}{8}$

---

750, 1 4 $\frac{1}{16}$

£ 375 1 4 $\frac{1}{16}$  ster.

2

---

7,50 2 9 $\frac{1}{16}$

20

---

10,02

12

---

0,33

4

---

1,35

£ 7 10 0 $\frac{1}{4}$  + Commission.

[101]

$$\begin{array}{rcl} m. & m. & \text{£.} \\ 12 : 6 :: 6 : \frac{6 \times 6}{12} = 3 \end{array}$$

$$\begin{array}{rcl} \text{£.} & \text{£.} & \text{£.} \\ 103 : 100 :: 440 & & \\ & & 100 \end{array}$$

$$\begin{array}{r} 103)44000(427 \ 3 \ 8\frac{1}{2} \\ \underline{412} \quad 220 \end{array}$$

$$\begin{array}{r} 280 \ 207 \ 3 \ 8\frac{1}{2} \\ 206 \quad + \text{Ans.} \end{array}$$

$$\begin{array}{r} 740 \\ 721 \\ \hline 19 \\ 20 \end{array}$$

$$\begin{array}{r} 380 \\ 309 \end{array}$$

$$\begin{array}{r} 71 \\ 12 \end{array}$$

$$\begin{array}{r} 852 \\ 824 \end{array}$$

$$\begin{array}{r} 28 \\ 4 \end{array}$$

$$\begin{array}{r} 112 \\ 103 \end{array}$$

$$\begin{array}{r} 9 \end{array}$$

[102]

38

$$\begin{array}{rcl} & C. \text{ gr. lb.} & \\ A & 10 \ 3 \ 14 & \\ B & 12 \ 1 \ 17 & 112)152(1 \ 1 \ 12 \\ C & 13 \ 1 \ 19 & 112 \\ D & 11 \ 2 \ 10 & \\ \hline & & 28)40 \\ & & 28 \\ & & \hline & & 12 \end{array}$$

$$\begin{array}{rcl} & L. & s. & d. \\ 46 \ 3 \ 20 & \text{at} & 0 \ 18 \ 0 & \text{per C.} \\ & & 46 \end{array}$$

$$\begin{array}{rcl} 2 \ 00 & \frac{1}{2} & \\ \hline 41 & 8 \ 0 \\ 1 \ 00 & \frac{1}{2} & 9 \ 0 \\ 16 & \frac{1}{7} & 4 \ 6 \\ 4 & \frac{1}{4} & 2 \ 6\frac{3}{4} \\ & & \hline & & 0 \ 7\frac{1}{4} \end{array}$$

$$\text{prime cost } £42 \ 4 \ 8\frac{1}{2}$$

$$\begin{array}{rcl} & C. \text{ gr. lb.} & \\ A & 10 \ 3 \ 14 & \\ B & 12 \ 1 \ 17 & 28)76(2 \ 20 \\ \hline & & 56 \\ & & \hline & & 20 \end{array}$$

$$\begin{array}{rcl} & \text{£. s. d.} & \\ 22 \ 2 \ 11 & \text{at} & 1 \ 8 \ 0 \text{ per C.} \\ & & 22 \end{array}$$

$$\begin{array}{rcl} 2 \ 00 & \frac{1}{2} & \\ \hline 30 & 16 \ 0 \\ 8 & \frac{1}{7} & 14 \ 0 \\ 2 & \frac{1}{4} & 2 \ 0 \\ 1 & \frac{1}{7} & 6 \\ & & \hline & & 3 \end{array}$$

$$\begin{array}{r} 31 \ 12 \ 9 \end{array}$$





[104]

Suppose 24 and 12 their ages at marriage.

$$\begin{array}{r} 30 \quad 30 \\ \hline 54 \quad 42 \end{array}$$

$$2 : 1\frac{3}{7} :: 54 : \frac{54 \times 10 \times 1}{1 \times 7 \times 2} = \frac{270}{7} = 38\frac{4}{7}$$

Error  $3\frac{3}{7}$  too little.

Suppose 26 and 13 their ages at marriage.

$$\begin{array}{r} 30 \quad 30 \\ \hline 56 \quad 43 \end{array}$$

$$2 : 1\frac{3}{7} :: 56 : \frac{56 \times 10 \times 1}{1 \times 7 \times 2} = \frac{43}{1} = 40$$

Error 3 too little.

Pos.

Er.

24

 $3\frac{3}{7}$ 

26

3

 $3\frac{3}{7}$ 89 $\frac{1}{7}$ 

72

3

72

 $\frac{3}{7}$ 17 $\frac{1}{7}$  or 17 $\frac{2}{7}$ or 17 $\frac{2}{7} \div \frac{3}{7}$ 

$$\frac{40 \quad 1}{120 \times 7}$$

$$\frac{7 \times 3}{1 \quad 1}$$

= 40 his age at marriage  
20 her do.

40 and 20

60 60

100 and 80 their ages at death.

## A SHORT COLLECTION OF PLEASANT AND DIVERTING QUESTIONS.

[1]

Suppose 5, and 7, at each corner :

then  $\overline{10}$  and  $\overline{14}$  will appear on each side ; to  
which add 8 and 4 between each corner to make  
 $\overline{18}$  and  $\overline{18}$  appear on each side ; and this will  
require,

$$\left. \begin{array}{l} 5 \times 4 + 8 \times 4 = 52 \\ \text{and} \\ 7 \times 4 + 4 \times 4 = 44 \end{array} \right\} \text{men. By the first the errors}$$

52

52

52

48

56

40

will be  $+4a^*$ , $-4b$ , $+12c$ ; by the

44,

44,

44,

48

56

40

second,  $-4d$ , $-12c$ , $+4f$ . Whence

$$\left. \begin{array}{l} 5 \times 4d + 7 \times 4a \quad 20 + 28 \quad 48 \\ \hline 4 + 4 \quad 8 \quad 8 \\ 5 \times 12c + 7 \times 4b \quad 60 + 28 \quad 88 \\ \hline 4 + 12 \quad 8 \quad 8 \\ 5 \times 4f + 7 \times 12c \quad 20 + 84 \quad 104 \\ \hline 12 + 4 \quad 8 \quad 8 \end{array} \right\} \begin{array}{l} \text{at each corner; and} \\ \left\{ \begin{array}{l} 18 - 2 \times 6 = 6 \\ 18 - 2 \times 4 = 10 \\ 18 - 2 \times 8 = 2 \end{array} \right\} \text{between each corner.} \end{array}$$

corner. side.

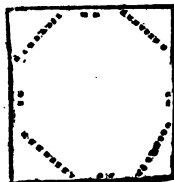
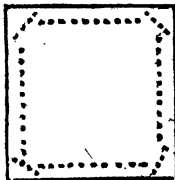
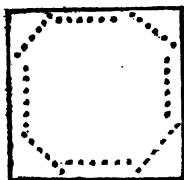
$$\text{PROOF. } (6 + 6) \times 4 = 48$$

$$(4 + 10) \times 4 = 56$$

$$(8 + 2) \times 4 = 40$$

\* Note.  $a, b, c$ , &c. are introduced to distinguish where the respective errors are used.

The following figures may serve to explain the manner of placing the men.



[2]

This is of that kind called *Indeterminate*, or *Unlimited*, in books of Algebra; and may be solved thus: suppose  $x =$  the number of eggs; then will  $\frac{x-1}{2}$ ,  $\frac{x-1}{3}$ ,  $\frac{x-1}{4}$  and  $\frac{x}{5}$  be whole numbers, from the conditions of the question. But it is well known that the product, sum, or difference, of whole numbers is either a whole number, or nothing; and therefore,

$$\frac{x-1}{2} + \frac{x-1}{3} + \frac{x-1}{4} + \frac{x}{5} = (\text{by reducing them to a common denominator}) \frac{30x-30}{60} + \frac{20x-20}{60} + \frac{15x-15}{60} + \frac{12x}{60}$$

$$= \frac{77x-65}{60} = x-1 + \frac{17x-5}{60} : \text{consequently } \frac{17x-5}{60} = \text{wh.}$$

a whole number; and (since  $x$  is also a whole number)

$$\frac{60x}{60} - 3 \times \frac{17x-5}{60} = \frac{9x+15}{60} = \text{wh. or } 2 \times \frac{9x+15}{60} -$$

$$\frac{17x-5}{60} = \frac{x+35}{60} = \text{wh.} = p; \text{ from which } x + 35 =$$

$60p$ , or  $x = 60p - 35$ ; where  $p$  may be any whole number assumed at pleasure. Let  $p = 1$ , then  $x = 60 \times 1 - 35 = 25$ . Let  $p = 2$ , then  $x = 60 \times 2 - 35 = 85$ . From these it appears that the question admits an infinite number of answers; being an arithmetical series, of which the least term, or answer, is 25 and the common difference  $(85 - 25 =) 60$ ; the answers being 25, 85, 145, 205, &c. *ad infinitum*.

[3]

This, also, is an *indeterminate problem*; in which put  $x =$  the number of the pigeons,  $y =$  that of the larks; then by the question,  $20 - x - y =$  that of the sparrows, and  $16x + 2y + 20 - x - y = 80$ ; or  $15x + y = 60$ ; or  $15x = 60 - y$ ; or  $x = \frac{60-y}{15} = 4 - \frac{y}{15}$ . Whence it is evident,

since  $y$  must be a whole number less than 20, that  $y = 15$ , the number of larks;  $x = \frac{60-y}{15} = \frac{60-15}{15} = \frac{45}{15} = 3$ ; the number of pigeons; and  $20 - x - y = 20 - 15 - 3 = 2$ , the number of sparrows.

		<i>d.</i>	<i>d.</i>
Proof.	3 pigeons	at 4	= 12
	15 larks	at $\frac{1}{2}$	$7\frac{1}{2}$
	2 sparrows	at $\frac{1}{4}$	$\frac{1}{2}$
	<hr/>		<hr/>
	20		20

[4]

8      3      4

1      5      9

6      7      2

[5]

 $11\frac{1}{2} = 12.$  Or  $3 + 3 + 3 + 3 = 12$ 

[6]

Since the fox will not eat the corn, let the goose be taken over first; then the fox must be taken over, and the goose carried back again, and left until the corn is carried over; this he can leave with the fox, and return for the goose.

[7]

Let two women go over first, and one return for the other; then let one return and stay with her husband while the other men go over to their wives. Then a man and his wife must return with the boat and the two men must go over and stay while the woman, already over, goes twice to bring their wives.

[8]

Fill the 5 gallon vessel, and out of this fill the 3; then empty this into the 8, and pour the remaining in the 5 into the 3. Then fill the 5 from the 8; and from the 5 fill the 3: this done there will remain 4 in the 5.

[9]

 $33\frac{2}{3} = 34$

# A KEY TO DILWORTH'S ARITHMETIC.

## PART V.

### DUODECIMALS.

#### ADDITION OF DUODECIMALS.

<i>Ft. in. " ' "</i>	<i>Ft. in. " ' "</i>
115 5 1 4 3	256 1 8 4 8

<i>Ft. in.</i>	<i>"</i>	<i>'</i>
17 10	2	1
20 4	0	7
49 6	9	0
80 0	10	0
17 0	0	4
60 0	10	0
37 0	0	9
<hr/>		
281 10	8	9

#### SUBTRACTION OF DUODECIMALS.

<i>Ft. in. " ' "</i>	<i>Ft. in. " ' "</i>	<i>Ft. in. " ' "</i>
74 3 4 7 6	100 5 7 8 1	800 3 4 0 0
19 4 1 8 10	97 8 9 10 11	70 3 7 10 5
<hr/>		
54 11 2 10 8	2 8 9 4 2	729 11 8 1 7

#### MULTIPLICATION OF DUODECIMALS.

##### 1. OF FEET AND INCHES.

<i>F. in.</i>	<i>F. in.</i>	<i>F. in.</i>	<i>F. in.</i>	<i>F. in.</i>
7 5	4 6	9 7	8 3	4 7
3 9	5 8	9 7	6 4	5 10
<hr/>				
22 3	22 6	86 3	49 6	22 11
5 6 9	3 0	5 7 1	2 9	3 9 10
<hr/>				
27 9 9	25 6	91 10 1	52 3	26 8 10

# 304 MULTIPLICATION OF DUODECIMALS.

<i>F. in.</i>	<i>F. in.</i>	<i>F. in.</i>	<i>F. in.</i>	<i>F. in.</i>
3 8	9 7	3 11	6 5	7 10
7 6	3 6	9 5	7 6	8 11
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
25 8	28 9	35 3	44 11	62 8
1 10	4 9 6	1 7 7	3 2 6	7 2 2
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
27 6	33 6 6	36 10 7	48 1 6	69 10 2

$$\begin{array}{r}
 \text{F. in.} \\
 46 \ 7 \\
 39 \ 8 \\
 \hline
 46 \times 9 = 414 \\
 46 \times 3 = 138 \\
 39 \times 7 = 22 \ 9 \\
 6 \ \frac{1}{2} \quad 23 \ 3 \ 6 \\
 2 \ \frac{1}{3} \quad 7 \ 9 \ 2 \\
 \hline
 1847 \ 9 \ 8
 \end{array}$$

$$\begin{array}{r}
 \text{F. in.} \\
 71 \ 7 \\
 84 \ 6 \\
 \hline
 71 \times 4 = 284 \\
 71 \times 8 = 568 \\
 84 \times 7 = 49 \\
 6 \ \frac{1}{2} \quad 35 \ 9 \ 6 \\
 \hline
 6048 \ 9 \ 6
 \end{array}$$

$$\begin{array}{r}
 \text{F. in.} \\
 76 \ 7 \\
 19 \ 10 \\
 \hline
 76 \times 9 = 684 \\
 76 \times 1 = 76 \\
 19 \times 7 = 11 \ 1 \\
 6 \ \frac{1}{2} \quad 38 \ 3 \ 6 \\
 4 \ \frac{1}{3} \quad 25 \ 6 \ 4 \\
 \hline
 1518 \ 10 \ 10
 \end{array}$$

$$\begin{array}{r}
 \text{F. in.} \\
 36 \ 1 \\
 18 \ 8 \\
 \hline
 36 \times 18 = 648 \\
 6 \ \frac{1}{2} \quad 18 \ 0 \ 6 \\
 2 \ \frac{1}{3} \quad 6 \ 0 \ 2 \\
 \hline
 672 \ 0 \ 8
 \end{array}$$

$$\begin{array}{r}
 \text{F. in.} \\
 84 \ 3 \\
 95 \ 2 \\
 \hline
 84 \times 5 = 420 \\
 84 \times 9 = 756 \\
 95 \times 3 = 23 \ 9 \\
 2 \ \frac{1}{6} \quad 14 \ 0 \ 6 \\
 \hline
 8017 \ 9 \ 6
 \end{array}$$

$$\begin{array}{r}
 \text{F. in.} \\
 48 \ 7 \\
 26 \ 8 \\
 \hline
 48 \times 6 = 288 \\
 48 \times 2 = 96 \\
 26 \times 7 = 15 \ 2 \\
 6 \ \frac{1}{2} \quad 24 \ 3 \ 6 \\
 2 \ \frac{1}{3} \quad 8 \ 1 \ 2 \\
 \hline
 1295 \ 6 \ 8
 \end{array}$$

*F. in.*

79 8

38 11

$$79 \times 3 = 632$$

$$79 \times 3 = 237$$

$$38 \times 8 = 25 \ 4$$

$$6 \ \frac{1}{2} \quad 39 \ 10$$

$$4 \ \frac{1}{3} \quad 26 \ 6 \ 8$$

$$1 \ \frac{1}{4} \quad 6 \ 7 \ 8$$

$$3100 \ 4 \ 4$$

*F. in.*

767 5

198 3

$$767 \times 8 = 6136$$

$$767 \times 9 = 6903$$

$$767 \times 1 = 767$$

$$198 \times 5 = 82 \ 6$$

$$3 \ \frac{1}{4} \quad 191 \ 10 \ 3$$

$$152140 \ 4 \ 3$$

*F. in.*

127 6

184 8

$$127 \times 4 = 508$$

$$127 \times 8 = 1016$$

$$127 \times 1 = 127$$

$$184 \times 6 = 92$$

$$6 \ \frac{1}{2} \quad 63 \ 9$$

$$2 \ \frac{1}{3} \quad 21 \ 3$$

$$23545 \ 0$$

*F. in.*

7691 10

1976 11

$$7691 \times 6 = 46146$$

$$7691 \times 7 = 53837$$

$$7691 \times 9 = 69219$$

$$7691 \times 1 = 7691$$

$$1976 \times 10 = 1646 \ 8$$

$$6 \ \frac{1}{2} \quad 3845 \ 11$$

$$4 \ \frac{1}{3} \quad 2563 \ 11 \ 4$$

$$1 \ \frac{1}{4} \quad 640 \ 11 \ 10$$

$$15206113 \ 6 \ 2$$

## 2. FEET, INCHES AND SECONDS.

*F. in. "*

8 6 9

7 3 8

59 11 3

2 1 8 3

5 8 6

62 6 7 9

*F. in. "*

3 10 6

7 4 8

27 1 6

1 3 6

2 7

28 7 7

*F. in. "*

7 1 9

7 8 9

50 0 3

4 9 2 0

5 4 3 9

55 2 9 3 9

# 306 MULTIPLICATION OF DUODECIMALS.

<i>F. in. "</i>	<i>F. in. "</i>	<i>F. in. "</i>
3 8 4	9 8 7	9 8 7
3 9 2	12 3 10	6 5 4
<hr/>		
11 1 0	116 7 0	58 3 6
2 9 3 0	2 5 1 9	4 0 6 11
7 4 8	8 1 1 10	3 2 10 4
<hr/>		
13 10 10 4 8	119 8 2 10 10	62 7 3 9 4

<i>F. in. "</i>	<i>F. in. "</i>
3 2 1	5 6 7
2 3 4	8 9 10
<hr/>	
6 4 2	44 4 8
9 6 3	4 2 11 3
1 0 8 4	4 7 5 10
<hr/>	
7 2 8 11 4	48 11 2 8 10

<i>F. in. "</i>	<i>F. in. "</i>
87 3 4	49 3 1
18 1 7	48 1 2

$$\begin{array}{r}
 87 \times 18 = 1566 \\
 3 \times 18 = 4 \ 6 \\
 4 \times 18 = 6 \\
 1 \times \frac{1}{2} = 7 \ 3 \ 3 \ 4 \\
 6 \times \frac{1}{2} = 3 \ 7 \ 7 \ 8 \\
 1 \times \frac{1}{6} = 0 \ 7 \ 3 \ 3 \ 4 \\
 \hline
 1582 \ 6 \ 2 \ 3 \ 4
 \end{array}$$

$$\begin{array}{r}
 49 \times 8 = 392 \\
 49 \times 4 = 196 \\
 3 \times 48 = 12 \\
 1 \times 48 = 4 \\
 1 \times \frac{1}{2} = 4 \ 1 \ 3 \ 1 \\
 2 \times \frac{1}{6} = 0 \ 8 \ 2 \ 6 \ 2 \\
 \hline
 2369 \ 1 \ 5 \ 7 \ 2
 \end{array}$$

<i>F. in. "</i>	<i>F. in. "</i>
64 3 7	71 3 6
27 2 6	92 1 7

$$\begin{array}{r}
 64 \times 7 = 448 \\
 64 \times 2 = 128 \\
 3 \times 27 = 6 \ 9 \\
 7 \times 27 = 1 \ 3 \ 9 \\
 2 \times \frac{1}{2} = 10 \ 8 \ 7 \ 2 \\
 6 \times \frac{1}{4} = 2 \ 8 \ 1 \ 9 \ 6 \\
 \hline
 1749 \ 5 \ 5 \ 11 \ 6
 \end{array}$$

$$\begin{array}{r}
 71 \times 2 = 142 \\
 71 \times 9 = 639 \\
 3 \times 92 = 23 \\
 6 \times 92 = 3 \ 10 \\
 1 \times \frac{1}{2} = 5 \ 11 \ 3 \ 6 \\
 6 \times \frac{1}{2} = 2 \ 11 \ 7 \ 9 \\
 1 \times \frac{1}{6} = 0 \ 5 \ 11 \ 3 \ 6 \\
 \hline
 6568 \ 2 \ 10 \ 6 \ 6
 \end{array}$$



# MULTIPLICATION OF DUODECIMALS. 307

*F. in. "*

71 3 6

81 1 8

$$71 \times 1 = 71$$

$$71 \times 8 = 568$$

$$2 \times 81 = 13 \ 6$$

$$6 \times 81 = 3 \ 4 \ 6$$

$$1 \ \frac{1}{2} \quad 5 \ 11 \ 2 \ 6$$

$$6 \ \frac{1}{3} \quad 2 \ 11 \ 7 \ 3$$

$$2 \ \frac{1}{2} \quad 0 \ 11 \ 10 \ 5$$

5777 9 2 3

*F. in. "*

56 1 8

97 3' 9

$$56 \times 7 = 392$$

$$56 \times 9 = 504$$

$$1 \times 97 = 8 \ 1$$

$$8 \times 97 = 5 \ 4 \ 8$$

$$4 \ \frac{1}{4} \quad 14 \ 0 \ 5$$

$$9 \ \frac{1}{4} \quad 3 \ 6 \ 1 \ 3$$

5463 0 2 3

*F. in. "*

756 1 8

184 2 6

$$756 \times 4 = 3024$$

$$756 \times 18 = 13608$$

$$1 \times 184 = 15 \ 4$$

$$8 \times 184 = 10 \ 2 \ 8$$

$$2 \ \frac{1}{8} \quad 126 \ 0 \ 3 \ 4$$

$$6 \ \frac{1}{4} \quad 31 \ 6 \ 0 \ 10$$

139287 1 0 2

*F. in. "*

371 2 6

181 1 9

$$371 \times 1 = 371$$

$$371 \times 18 = 6678$$

$$2 \times 181 = 30 \ 2$$

$$6 \times 181 = 7 \ 6 \ 6$$

$$1 \ \frac{1}{2} \quad 30 \ 11 \ 2 \ 6$$

$$6 \ \frac{1}{3} \quad 15 \ 5 \ 7 \ 3$$

$$3 \ \frac{1}{3} \quad 7 \ 8 \ 9 \ 7 \ 6$$

67242 10 1 4 6

*F. in. "*

487 11 10

186 10 11

$$487 \times 6 = 2922$$

$$487 \times 18 = 8766$$

$$11 \times 186 = 170 \ 6$$

$$10 \times 186 = 12 \ 11$$

$$6 \ \frac{1}{2} \quad 243 \ 11 \ 11$$

$$4 \ \frac{1}{3} \quad 162 \ 7 \ 11 \ 4$$

$$8 \ \frac{1}{6} \quad 27 \ 1 \ 3 \ 10 \ 8$$

$$2 \ \frac{1}{4} \quad 6 \ 9 \ 3 \ 11 \ 8$$

$$1 \ \frac{1}{2} \quad 3 \ 4 \ 7 \ 11 \ 10$$

91209 4 2 3 2

$$\begin{array}{r} F. \text{ in. } '' \\ 2)146 \ 7 \ 10 \\ \hline \end{array}$$

$$73 \ 3 \ 11$$

$$\begin{array}{r} F. \text{ in. } '' \\ 5)186 \ 1 \ 10 \\ \hline \end{array}$$

$$37 \ 2 \ 9\frac{1}{5}$$

$$\begin{array}{r} F. \text{ in. } '' \\ 8)712 \ 8 \ 4 \\ \hline \end{array}$$

$$89 \ 1 \ 0 \ 6$$

$$\begin{array}{r} F. \text{ in. } '' \\ 11)123 \ 4 \ 5 \\ \hline \end{array}$$

$$11 \ 2 \ 7$$

$$\begin{array}{r} F. \text{ in. } '' \ '' \ '' \\ 8)98 \ 4 \ 6 \ 6 \ 1 \\ \hline \end{array}$$

$$12 \ 3 \ 6 \ 9 \ 9\frac{1}{8}$$

$$\begin{array}{r} F. \text{ in. } '' \ '' \ '' \\ 10)47 \ 3 \ 4 \ 9 \ 1 \\ \hline \end{array}$$

$$4 \ 8 \ 8 \ 10 \ 1\frac{3}{10}$$

$$\begin{array}{r} F. \text{ in. } '' \ '' \ '' \\ 12)83 \ 1 \ 6 \ 9 \ 10 \\ \hline \end{array}$$

$$6 \ 11 \ 1 \ 6 \ 9 \ 10$$

$$\begin{array}{r} F. \text{ in. } F. \text{ in. } '' \ F. \text{ in. } \\ 6 \ 7)31 \ 3 \ 3(4 \ 9 \\ 26 \ 4 \\ \hline \end{array}$$

$$4 \ 11 \ 3$$

$$4 \ 11 \ 3$$

$$\begin{array}{r} F. \text{ in. } '' \\ 3)761 \ 4 \ 11 \\ \hline \end{array}$$

$$253 \ 9 \ 7 \ 8$$

$$\begin{array}{r} F. \text{ in. } '' \\ 6)76 \ 3 \ 11 \\ \hline \end{array}$$

$$12 \ 8 \ 7 \ 10$$

$$\begin{array}{r} F. \text{ in. } '' \\ 9)912 \ 3 \ 5 \\ \hline \end{array}$$

$$101 \ 4 \ 4\frac{5}{9}$$

$$\begin{array}{r} F. \text{ in. } '' \\ 12)76 \ 8 \ 7 \\ \hline \end{array}$$

$$6 \ 4 \ 8 \ 7$$

$$\begin{array}{r} F. \text{ in. } '' \\ 4)963 \ 2 \ 10 \\ \hline \end{array}$$

$$240 \ 9 \ 8 \ 6$$

$$\begin{array}{r} F. \text{ in. } '' \\ 7)186 \ 1 \ 10 \\ \hline \end{array}$$

$$26 \ 7 \ 1\frac{3}{7}$$

$$\begin{array}{r} F. \text{ in. } '' \\ 10)861 \ 11 \ 10 \\ \hline \end{array}$$

$$86 \ 2 \ 4\frac{6}{10}$$

$$\begin{array}{r} F. \text{ in. } '' \ '' \ '' \\ 7)86 \ 3 \ 7 \ 4 \ 8 \\ \hline \end{array}$$

$$12 \ 3 \ 11 \ 4 \ 1\frac{1}{7}$$

$$\begin{array}{r} F. \text{ in. } '' \ '' \ '' \\ 9)86 \ 2 \ 1 \ 1 \ 7 \\ \hline \end{array}$$

$$9 \ 6 \ 10 \ 9 \ 6\frac{1}{9}$$

$$\begin{array}{r} F. \text{ in. } '' \ '' \ '' \\ 11)96 \ 2 \ 7 \ 11 \ 4 \\ \hline \end{array}$$

$$8 \ 8 \ 11 \ 7 \ 6\frac{10}{11}$$

$$\begin{array}{r} F. \text{ in. } '' \ '' \ '' \\ 12)78 \ 10 \ 11 \ 10 \ 9 \\ \hline \end{array}$$

$$6 \ 6 \ 10 \ 11 \ 10 \ 9$$

$$\begin{array}{r} F. \text{ in. } F. \text{ in. } '' \ F. \text{ in. } \\ 8 \ 10)87 \ 7 \ 2(9 \ 11 \\ 79 \ 6 \\ \hline \end{array}$$

$$8 \ 1 \ 2$$

$$8 \ 1 \ 2$$

$$\begin{array}{r} F. in. \quad F. in. \quad '' \quad F. in. \\ 8 \quad 9)83 \quad 10 \quad 3(9 \quad 7 \\ \underline{78 \quad 9} \end{array}$$

$$\begin{array}{r} 5 \quad 1 \quad 3 \\ 5 \quad 1 \quad 3 \end{array}$$

$$\begin{array}{r} F. in. \quad F. in. \quad '' \quad F. in. \\ 12 \quad 9)130 \quad 8 \quad 3(10 \quad 3 \\ \underline{127 \quad 6} \end{array}$$

$$\begin{array}{r} 3 \quad 2 \quad 3 \\ 3 \quad 2 \quad 3 \end{array}$$

$$\begin{array}{r} F. in. \quad F. in. \quad '' \quad F. in. \\ 11 \quad 5)140 \quad 9 \quad 8(12 \quad 4 \\ \underline{137 \quad 0} \end{array}$$

$$\begin{array}{r} 3 \quad 9 \quad 8 \\ 3 \quad 9 \quad 8 \end{array}$$

$$\begin{array}{r} F. in. \quad F. in. \quad '' \quad F. in. \\ 9 \quad 3)116 \quad 4 \quad 9(12 \quad 7 \\ \underline{111 \quad 0} \end{array}$$

$$\begin{array}{r} 5 \quad 4 \quad 9 \\ 5 \quad 4 \quad 9 \end{array}$$

$$\begin{array}{r} F. in. \quad F. in. \quad '' \quad F. in. \\ F. in. \quad 39 \quad 8)1847 \quad 9 \quad 8(46 \quad 7 \\ 39 \quad 8 \times 40 = 1586 \quad 8 \end{array}$$

$$\begin{array}{r} 261 \quad 1 \\ 39 \quad 8 \times 6 = 238 \quad 0 \end{array}$$

$$\begin{array}{r} in. \quad 23 \quad 1 \quad 8 \\ 39 \quad 8 \times 7 = 23 \quad 1 \quad 8 \end{array}$$

$$\begin{array}{r} F. in. \quad F. in. \quad '' \quad F. in. \\ F. in. \quad 84 \quad 6)6048 \quad 9 \quad 6(71 \quad 7 \\ 84 \quad 6 \times 70 = 5915 \quad 0 \end{array}$$

$$\begin{array}{r} 133 \quad 9 \\ 84 \quad 6 \times 1 = 84 \quad 6 \end{array}$$

$$\begin{array}{r} 49 \quad 3 \quad 6 \\ 49 \quad 3 \quad 6 \end{array}$$

$$\begin{array}{r} F. in. \quad F. in. \quad '' \quad F. in. \\ F. in. \quad 19 \quad 10)1518 \quad 10 \quad 10(76 \quad 7 \\ 19 \quad 10 \times 70 = 1388 \quad 4 \end{array}$$

$$\begin{array}{r} 130 \quad 6 \\ 19 \quad 10 \times 6 = 119 \quad 0 \end{array}$$

$$\begin{array}{r} 11 \quad 6 \quad 10 \\ 11 \quad 6 \quad 10 \end{array}$$

$$\begin{array}{r}
 \text{F. in.} \quad \text{F. in.} \quad \text{F. in.} \quad \text{F. in.} \\
 \text{F. in.} \quad 95 \quad 2)8017 \quad 9 \quad 6(84 \quad 3 \\
 95 \quad 2 \times 80 = 7613 \quad 4
 \end{array}$$

$$\begin{array}{r}
 404 \quad 5 \\
 95 \quad 2 \times 4 = 380 \quad 8 \\
 \hline
 23 \quad 9 \quad 6 \\
 23 \quad 9 \quad 6
 \end{array}$$

$$\begin{array}{r}
 \text{F. in.} \quad \text{F. in.} \quad \text{F. in.} \quad \text{F. in.} \\
 \text{F. in.} \quad 26 \quad 8)1895 \quad 6 \quad 8(71 \quad 1 \\
 26 \quad 8 \times 70 = 1866 \quad 8
 \end{array}$$

$$\begin{array}{r}
 28 \quad 10 \\
 26 \quad 8 \\
 \hline
 2 \quad 2 \quad 8 \\
 2 \quad 2 \quad 8
 \end{array}$$

$$\begin{array}{r}
 \text{F. in.} \quad \text{F. in.} \quad \text{F. in.} \quad \text{F. in.} \\
 \text{F. in.} \quad 18 \quad 8)673 \quad 6 \quad 8(36 \quad 1 \\
 18 \quad 8 \times 30 = 560 \quad 0
 \end{array}$$

$$\begin{array}{r}
 113 \quad 6 \\
 112 \quad 0 \\
 \hline
 1 \quad 6 \quad 8 \\
 1 \quad 6 \quad 8
 \end{array}$$

$$\begin{array}{r}
 \text{F. in.} \quad \text{F. in.} \quad \text{F. in.} \quad \text{F. in.} \\
 7 \quad 3 \quad 8)62 \quad 6 \quad 7 \quad 9(8 \quad 6 \quad 9 \\
 58 \quad 5 \quad 4
 \end{array}$$

$$\begin{array}{r}
 4 \quad 1 \quad 3 \quad 9 \\
 3 \quad 7 \quad 10 \quad 0
 \end{array}$$

$$\begin{array}{r}
 5 \quad 5 \quad 9 \quad 0 \\
 5 \quad 5 \quad 9 \quad 0
 \end{array}$$

$$\begin{array}{r} F. \text{ in. } " \quad F. \text{ in. } " \quad F. \text{ in. } " \\ 3 \ 10 \ 6) 28 \ 7 \ 7(7 \ 4 \ 8 \\ \quad \quad \quad 27 \ 1 \ 6 \end{array}$$

$$\begin{array}{r} 1 \ 6 \ 1 \ 0 \\ 1 \ 3 \ 6 \ 0 \end{array}$$

$$\begin{array}{r} 2 \ 7 \ 0 \ 0 \\ 2 \ 7 \ 0 \ 0 \end{array}$$

$$\begin{array}{r} F. \text{ in. } " \quad F. \text{ in. } " \quad " \quad " \quad F. \text{ in. } " \\ 7 \ 1 \ 9) 55 \ 2 \ 9 \ 3 \ 9(7 \ 8 \ 9 \\ \quad \quad \quad 50 \ 0 \ 3 \end{array}$$

$$\begin{array}{r} 5 \ 2 \ 6 \ 3 \\ 4 \ 9 \ 2 \ 0 \end{array}$$

$$\begin{array}{r} 5 \ 4 \ 3 \ 9 \\ 5 \ 4 \ 3 \ 9 \end{array}$$

$$\begin{array}{r} F. \text{ in. } " \quad F. \text{ in. } " \quad " \quad " \quad F. \text{ in. } " \\ 3 \ 9 \ 2) 13 \ 10 \ 10 \ 4 \ 8(3 \ 8 \ 4 \\ \quad \quad \quad 11 \ 3 \ 6 \end{array}$$

$$\begin{array}{r} 2 \ 7 \ 4 \ 4 \\ 2 \ 6 \ 1 \ 4 \end{array}$$

$$\begin{array}{r} 1 \ 3 \ 0 \ 8 \\ 1 \ 3 \ 0 \ 8 \end{array}$$

$$\begin{array}{r} F. \text{ in. } " \quad F. \text{ in. } " \quad " \quad " \quad F. \text{ in. } " \\ 12 \ 3 \ 10) 119 \ 8 \ 2 \ 10 \ 10(9 \ 8 \ 7 \\ \quad \quad \quad 110 \ 10 \ 6 \end{array}$$

$$\begin{array}{r} 8 \ 9 \ 8 \ 10 \\ 8 \ 2 \ 6 \ 8 \end{array}$$

$$\begin{array}{r} 7 \ 2 \ 2 \ 10 \\ 7 \ 2 \ 2 \ 10 \end{array}$$

$$\begin{array}{r}
 F. \text{ in. } " \quad F. \text{ in. } " \quad ' \quad ' \quad ' \quad F. \text{ in. } " \\
 9 \quad 8 \quad 7 \quad 62 \quad 7 \quad 3 \quad 9 \quad 4(6 \quad 5 \quad 4 \\
 \quad \quad \quad 58 \quad 3 \quad 6
 \end{array}$$

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$$4 \quad 3 \quad 9 \quad 9$$

$$4 \quad 0 \quad 6 \quad 11$$

---


$$3 \quad 2 \quad 10 \quad 4$$

$$3 \quad 2 \quad 10 \quad 4$$

---


$$\begin{array}{r}
 F. \text{ in. } " \quad F. \text{ in. } " \quad ' \quad ' \quad ' \quad F. \text{ in. } " \\
 3 \quad 2 \quad 1 \quad 7 \quad 2 \quad 8 \quad 11 \quad 4(2 \quad 3 \quad 4 \\
 \quad \quad \quad 6 \quad 4 \quad 2
 \end{array}$$

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$$10 \quad 6 \quad 11$$

$$9 \quad 6 \quad 3$$

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$$1 \quad 0 \quad 8 \quad 4$$

$$1 \quad 0 \quad 8 \quad 4$$

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$$\begin{array}{r}
 F. \text{ in. } " \quad F. \text{ in. } " \quad ' \quad ' \quad ' \quad F. \text{ in. } " \\
 8 \quad 9 \quad 10 \quad 48 \quad 11 \quad 2 \quad 8 \quad 10(5 \quad 6 \quad 7 \\
 \quad \quad \quad 44 \quad 1 \quad 2
 \end{array}$$

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$$4 \quad 10 \quad 0 \quad 8$$

$$4 \quad 4 \quad 11 \quad 0$$

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$$5 \quad 1 \quad 8 \quad 10$$

$$5 \quad 1 \quad 8 \quad 10$$

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 THE END.  
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